FARM SCIENCE AND PRACTICE

67th ANNUAL REPORT

BULLETIN 680 NOVEMBER 1948

OHIO AGRICULTURAL EXPERIMENT STATION
WOOSTER, OHIO, U.S.A.

THE HONORABLE JAMES F. LINCOLN
PRESIDENT OF THE BOARD OF CONTROL
OHIO AGRICULTURAL EXPERIMENT STATION

DEAR SIR:

I HAVE THE HONOR TO PRESENT TO THE BOARD OF CONTROL FOR TRANSMISSION TO THE GOVERNOR OF OHIO, AS REQUIRED BY LAW, THE SIXTY-SEVENTH ANNUAL REPORT OF THE OHIO AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDED JUNE 30, 1948.

L. L. RUMMELL
Director

THE HONORABLE THOMAS J. HERBERT
GOVERNOR OF OHIO

DEAR SIR:

I HAVE THE HONOR TO PRESENT TO YOU THE SIXTY-SEVENTH ANNUAL REPORT OF THE OHIO AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDED JUNE 30, 1948.

JAMES F. LINCOLN
President, Board of Control

COVER PICTURE: Shown on the cover are beef cattle grazing near the Frye Barn at the Ohio Agricultural Experiment Station. Each year, various Open House meetings are held at the Frye Farm where cattlemen see experiments in progress and hear reports of research results.

Pictured from left to right are: G. A. Hummon, Business Manager; J. D. Bragg, Administrative Secretary; W. E. Krauss, Associate Director; R. M. Bethke, Assistant Director; L. L. Rummell, Director.

FOREWORD

For Year Ended June 30, 1948

This year in Ohio Agricultural Experiment Station history was marked by a change in administration and administrative policy. Effective January 1, 1948, the Experiment Station officially became more closely associated with the College of Agriculture at Columbus through action of the Board of Control whereby the Dean of the College serves also as Director of the Experiment Station. Shortly thereafter this organization pattern was extended so that comparable departments at both institutions are served by the same chairman. This will result in mutual benefit through more effective use of personnel and facilities for conducting research, for teaching, and for the training of graduate students.

Further reorganization was accomplished in the handling of operations and research on the 15 outlying farms to utilize them more effectively in meeting particular problems of the areas in which they are located.

Federal funds received under the Research and Marketing Act of 1946 have been applied to 18 research projects, eight of which are directly concerned with marketing and consumer acceptability of farm products.

Expanding finances through such increased Federal support and grants-in-aid, together with acute maintenance problems resulting from war-time labor shortages and inadequate funds, necessitated introduction of new business procedures and physical plant improvements to expedite the research program.

Appropriations made by the 97th General Assembly for acquisition of new land and provision of a new heating plant, horticulture building, swine plant, large-animal nutrition laboratory, dairy calf barn, botany headhouse, and agronomy greenhouses, resulted in great activity in the development of plans, selection of sites, and inspection and acquisition of new land. In order that the immediate and future building programs be in keeping with the needs and at the same time be in good architectural taste and in accordance with sound land-use policies, the services of a master planner were obtained in locating buildings, roads, and plantings.

Somewhat handicapped by inability to bring the scientific staff back to full strength following the War, the research program has nevertheless gone forward and produced many outstanding accomplishments, which are noted in this report. The spirit of loyalty and service that has made these accomplishments possible is a tribute to the research worker and his supporting helpers and typifies the firm foundation underlying the development of agricultural science in publicly supported institutions.

DIRECTOR

Topics Discussed

Farm Income and Living

More Farms Operated by Owners

Since 1940 the trend has been for an increasing percent of Ohio farms to be operated by owners. In 1945 21.8 percent of Ohio farms were operated by tenants as contrasted to 26.3 percent in 1940. In 1940 about 61 percent of Ohio farm land was operated by owners while in 1945 it was 63 percent.

A recent study of Ohio farm leases indicates that about three-fourths of rented farms in Ohio are rented on a share basis. The livestock share lease is becoming more prevalent. Among the essentials in a good lease were found the following points: (1) Provide for and allow profitable farming, (2) give a fair division of returns between land owner and operator, (3) provide for a system of farming that will maintain or increase the productivity of the farm, and (4) give as much assurance as possible to the tenant that if a good job of farming is done the lease will be continued over a period of years.

J. I. Falconer

Passing Farms to the Next Generation

Research work relative to family farming plans and arrangements has disclosed that one of the major problems is that of passing ownership of the home farm to the next generation of operators. Work done on this problem revealed that there are two great uncertainties associated with the use of *wills* and *verbal agreements* to pass ownership:

(a) *Wills* were observed to get out of date and to be subject to change after other members of the family had performed obligations agreed upon as just and fair to all.

(b) *Verbal agreements* concerning real estate are not enforced by courts of law because they fail to meet the requirement that real estate contracts always be in writing.

The use of either of these methods to pass ownership is regarded as rather uncertain of final execution. On the other hand, a real estate contract, deed by sale or gift, or distribution according to the rules of inheritance are relatively certain methods for transferring farm titles of ownership to the next generation.

R. C. Headington

Fig. 1.—A certain plan of transfer of the home farm to the son will often insure that the son remains on the home farm.

Labor Efficiency in Dairy Chores

The time spent doing dairy chores may vary greatly on different farms having the same size herds. In a study of dairy chore labor efficiency it was found that one man may spend over 200 hours per cow in a year while another man may spend only 80 hours for each cow.

Some of the reasons that the second man spends less time are his use of feed and silage carts, hay being fed from mow directly into feed bunks, manure removed in wheel barrow, cows trained for fast milking, equipment in good repair and adjustment, and convenient placement of tools and proper organization of all dairy jobs.

R. H. Baker

Seasonal Milk Deliveries Little Affected by Price Plans

A study was conducted to determine the influence of price plans on the seasonal pattern of total milk received in the milk markets of Canton, Cincinnati, Columbus, and Dayton. A further analysis of 100 individual

producers was made to determine the influence of price plans on the seasonal pattern of deliveries of producers who delivered continuously to the same market for the period 1927-1946.

The price plan most widely used was the base-and-surplus plan, with minor deviations between markets. These markets introduced and discontinued such plans at different periods of time. It may be significant that the base-and-surplus plan has been in operation in Ohio for the most part during a period of rising milk prices.

A study of seasonal variation, after removing the influence of secular trend, shows that the fall milk deliveries of the average shipper in these Ohio markets remained at an approximately even level during the duration of the base-and-surplus plan in the individual market. During the operation of the plan, however, the spring milk deliveries increased; thus fall milk deliveries for the average shipper in the market actually decreased in percentage relation to spring deliveries. Producers who had delivered continuously for the years 1927-1946, whose records were studied, averaged higher ratios of fall to spring deliveries than those of all producers.

Since the introduction of base-and-surplus plans in the early 1930's there has been a definite upward trend in total milk delivered and a downward trend in the ratio of fall to spring deliveries. The base-and-surplus plans did not materially change this pattern.

C. G. McBride

Hog Prices Vary Among Markets

The analysis of hog prices shows that Ohio has been losing ground compared to other Corn Belt states. For example, for the 5-year period 1925 to 1929, Ohio hog prices at the farm were on the average 5 cents per hundredweight over Indiana, 33 cents over Illinois, 68 cents over Iowa, and 83 cents over Nebraska. By the 1940 to 1944 period, Ohio prices were equal to those of Indiana, only 17 cents over Illinois, 29 cents over Iowa, and 48 cents over Nebraska.

There also is brought out the relationship existing among the principal Ohio markets by months and by grades. For the 200- to 220-pound hogs, the Dayton market was relatively lower than other Ohio markets during November, December, and January. Columbus, on the other hand, was relatively good during December.

Geo. F. Henning

Maple Syrup Production Costs

Some factors affecting costs of maple syrup production can be controlled or modified and some—such as weather—can not be changed. The following circumstances are particularly important:

Size of business.—A bush hanging between 500 and 1,000 buckets appears to be the practical lower limit in size, if production as a commercial enterprise is the objective. Optimum utilization of labor and equipment is approached in some bushes hanging 1,200 to 1,500 buckets; but as a class those bushes hanging 1,600 or more buckets have had the lowest average costs.

Number of buckets hung per acre.—The bucket carry capacity (one bucket for each 9 inches of tree diameter) was found to vary from approximately 20 to over 100 buckets per acre with an average of 40. Gathering sap when the buckets are thinly scattered takes more time and travel. From the standpoint of land use the gross returns per acre increase in about the same proportion as the number of buckets hung.

Sweetness of sap.—The maples in some bushes consistently average sweeter sap than those in other bushes. Study is underway to determine how this difference is associated with physical qualities of the land and the trees. Sweetness of sap also varies from one tree to another which offers some opportunity for selection and culling within an existing wood and also for the propagation of a high producing strain of maple trees.

Volume of production per bucket hung.—The experience of the past 3 years indicates that the cost per gallon of syrup also tends to vary inversely with the volume produced per bucket hung. This difference appears to arise partly from timeliness in tapping and re-tapping to obtain a maximum flow of sap, and partly to site and tree characteristics.

Producer "know-how".—Managerial judgment and skills in operating a sugar bush have a definite influence on cost. Seasoned wood kept dry, timeliness in tapping to catch the first good run of sap and re-tapping at the proper time, equipment in good repair, an efficient evaporator, the sugar house in order, a supply of efficient labor—are some of the characteristics of management that enable some maple syrup producers to keep their costs relatively low.

H. R. Moore, R. H. Baker, and O. D. Diller

Cold Storage Lockers Gain in Popularity

The popularity of locker plant storage of food increased very materially from 1945 to 1948. This is indicated by the fact that the number of plants increased from about 250 to over 400 and the average size from about 540 lockers to about 650 per plant during this time. Only a few plants reported any substantial number of vacant lockers while many plants still had waiting lists early in 1948.

The average yearly retail charge for lockers was $12.80 per year in 1945 and $13.68 in early 1948. Processing rates had increased from 2.28 cents to 2.96 cents per pound. These increases meant only about one cent per pound extra cost per year for storing of food in frozen form.

Most locker plants were selling wholesale cuts of meat to locker patrons for storage. The sale of such meat to patrons amounted to 13 percent of total food stored in the lockers. Practically all of the meat sold was beef, although a few plants obtained large quantities of poultry for the patrons. Sale of pork to patrons for storage was very limited.

Only one plant reported the sale of prime beef to patrons for storage. Four plants handled only choice beef and sixteen handled good beef only. One plant sold only commercial beef to the patrons for storage in lockers. Eight plants handled both good and choice beef, four handled both good and commercial grades and three plants handled choice, good and commercial grades for sale at wholesale to patrons.

R. W. Sherman

Greater Merchandising Responsibility in Prepackaging

Studies of consumer acceptance in stores of a corporate chain grocery company in Columbus in 1945 were repeated in 1946, and revealed a preference for prepackaged fresh fruits and vegetables over conventional offerings among the patrons of these stores—about 85 in 100 preferred the former. Yet in the second inquiry a much larger proportion of patrons was accepting prepackaged goods with reservations about its quality. Consequently investigations were conducted in 1946 and 1947, with cooperation of the company, to study this problem.

During several weeks in each year many thousands of prepackaged consumer units of perishable produce displayed in these stores were examined critically as to age and quality. About 10 percent of the packages on display were found to contain inferior or deteriorated produce.

Fig. 2.—The packager and the retailer must assume some responsibility when prepackaged goods are offered to the public.

Almost 30 percent had been packaged more than 2 days, 13 percent more than 3 days, 6 percent more than 4 days, and a few as much as 10 to 15 days. In many displays, old and new stock was mingled, or older stock was found in less accessible positions, resulting in the older receipts being left in the displays long enough to show some decline in quality or condition while awaiting sale.

More than one-half the packages containing inferior or deteriorated produce were offered at first quality prices. They were not segregated unless the deterioration was pronounced and conspicuous, and so long as the price was not reduced their inferiority might readily have escaped detection until opened by the purchaser. Under these circumstances opportunities existed for patrons to purchase packaged units that turned out to be unsatisfactory, thus detracting from the sales volume and reputation of the vendor.

Obviously prepackaging of perishable foods calls for exacting care at all points—grading, packing, distributing, merchandising. Since packaging interferes to some extent with the consumer's ability to form an independent judgment of the goods, the packer or retailer cannot escape a greater responsibility than before, and can earn the continued confidence of his customers only by maintaining a high standard of quality and freshness in his offerings.

Charles W. Hauck

Rural Health and Social Adjustment

Beginning with a survey of mental and social health needs and resources in a typical county, three major outcomes are now observable.

Basic research was undertaken for the purpose of evaluating the relative merits of farm, village, and small city homes as settings for the personality development of children. It was found that the average level of mental health was, at the time and place of the survey, significantly higher among farm and village children than among urban boys and girls. Research also indicated a general improvement in the mental health status of children between 1946 and 1947, the improvement being most pronounced among urban children.

Public education.—This project has resulted in an active program of popular education and publicity concerning vital problems of human development. The survey county (Miami) has organized an active mental hygiene society, employed a full-time executive secretary, and carried out effective programs of mental health education. Other Ohio counties are following patterns set in this area.

Public services.—A major benefit of this project is the establishment of the Upper Miami Valley Guidance Center with branches in Piqua and Troy. This center will serve the mental health needs of a wide area. It is sponsored by the Ohio Department of Public Welfare and the Miami County Mental Health Association, and financed under the terms of the National Mental Health Act. This center provides an excellent field laboratory for further research in human problems.

A. R. Mangus

Dairying

Temperature of Udder Wash Water

Milking cows efficiently and rapidly requires good management. Being regular in all operations is the important factor in training cows to milk rapidly and completely. This observation is based upon a series of milking experiments conducted with 12 cows in the peak of lactation and 2 cows in the latter part of the lactation period.

Conditions of this experiment relating to preparation and milking of the cows were standard, except temperatures of the udder wash water, which were as follows: Cold (50° and 64° F.), warm (100° F.), and hot (132° F.). Related factors, such as the inheritance of cows to milk at slow, medium, or rapid rates, season of the year, effects of additional oxytocin, and variation in milking machine vacuum, were included in this study.

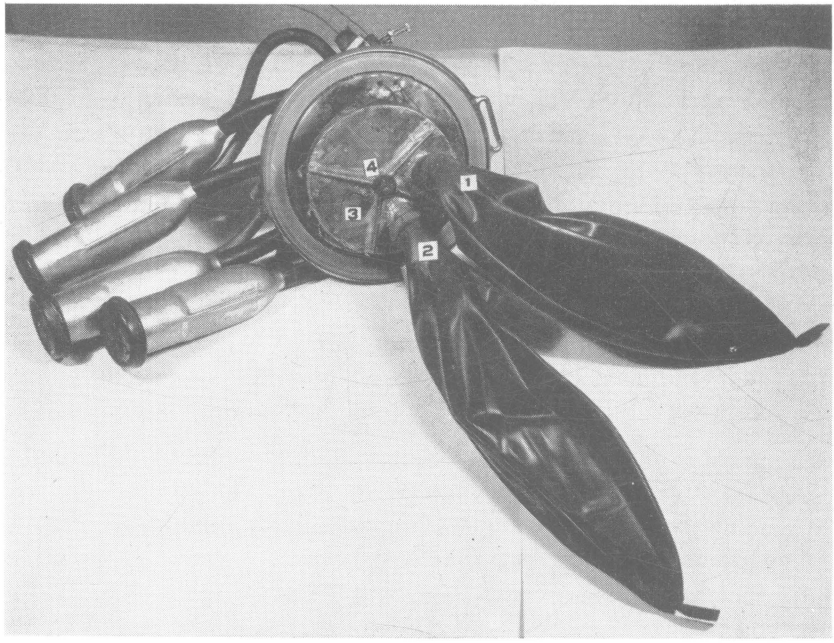

Fig. 3.—Shown above are the experimental milking machine collection chamber and rubber bags used to collect milk at certain intervals during the milking process. The first and second collections of milk are collected in bags 1 and 2, respectively, by revolving disc 4.

Let-down of milk, as determined by the amounts of milk taken from these cows during the first 1 to 1½ minutes of milking time, total milk, and length of the total milking period, was not influenced by temperature of the udder wash water.

C. E. Knoop

Fig. 4.—Improved permanent pasture, with an abundance of white clover (taken July 23). The cows in this picture are a part of the two groups that also grazed the legume meadow mixtures at intervals.

Dairy Cows Respond to Good Midsummer Pastures

The milk-producing properties of legume meadow mixtures were again demonstrated during the 1947 grazing season. Seven Jersey cows were able to obtain almost their entire feed supply during 4 months from these pastures. These cows averaged 835 pounds of 4 percent milk per month on only 27 pounds of grain.

Additional evidence on the value of these pastures was obtained from two other comparable groups that were allowed to graze the meadows at intervals of 2 weeks. Both of these groups were fed more grain than the former group and, in addition, one of these groups was offered extra hay in the barn.

The lack of desire for the hay and the relatively low grain consumption of these cows indicated that the pastures must have been supplying nearly adequate amounts of feed. The hay eaten, which amounted to

less than one pound per day for each cow, did not result in an increase in milk production. These results were obtained under conditions of ample grazing, with the cows being rotated at frequent intervals onto fresh pasture.

Since the two groups that were used to graze the legume meadow mixtures also grazed the improved permanent pastures in the intervening periods, a comparison of the milk-producing properties of these two types of pastures was possible. Briefly, there was little or no difference in production on these two types of pastures. All the cows while on the permanent pasture were fed moderate amounts of extra hay. The permanent pastures remained in excellent condition throughout the season and contained an abundance of white clover.

C. F. Monroe and L. E. Thatcher

Can Increase Vitamin A of Newborn Calf

It is a well-known fact that under normal conditions the calf is born without a reserve supply of vitamin A. If vitamin A in some form is not provided the calf will live only a few days. During the past year a way of increasing the vitamin A reserves of the newborn calf was devised.

By feeding rather large amounts of vitamin A (1 million I. U. daily) to the cow during the last 4 weeks of pregnancy, the amount of this vitamin stored in the body of the newborn calf can be greatly increased and a further substantial increase can be obtained by including 10 grams of soybean lecithin with the vitamin A. This treatment of the cow not only increases the store of this important vitamin in the calf, but it also results in the production of colostrum containing larger quantities of the vitamin.

The inclusion of soybean lecithin in a vitamin A supplement given to calves during their early life also has beneficial effects. More of the vitamin is absorbed and retained by the calf when lecithin is fed. Although the practice is not recommended, it is possible to raise calves from birth on skimmilk plus a vitamin A-lecithin supplement.

T. S. Sutton

Colostrum is Rich in Tryptophan

Additional facts regarding the superior nutritive value of colostrum were obtained during the past year. It has been known for years that colostrum is rich in protein of high quality, although many of the details relative to the quality of the protein have not been investigated.

One research project under way this past year has shown that colostrum protein is particularly rich in the amino acid, tryptophan. This is the amino acid that serves as a precursor of niacin, the anti-pellagra vitamin. The blood of the newborn calf is quite low in trytophan, but after 3 days of colostrum feeding, the amount is about doubled. The high concentration of trytophan in colostrum probably explains why the newborn calf does not require a dietary source of niacin.

All of the experiments in which the nutritive value of colostrum and its value in calf feeding have been studied have shown: (1) That colostrum is rich in the nutrients required by the newborn calf, (2) That more healthy and vigorous calves are raised when all of the colostrum produced is used for calf feeding, and (3) That considerable marketable milk normally used for calf feeding can be sold if all of the colostrum is used in the raising of calves.

T. S. Sutton

Early Rumen Development in Calves

It was observed during the course of investigations concerning the etiology of digestive disturbance in calves that characteristic rumen microorganisms were not established in the majority of the calves examined until after they were many weeks old.

A method was developed for inoculating the rumens of the calves which consisted of placing small pieces of cud, removed from the mouths of cows, in the back of the calves' mouths. Even when this was done, it was found that the organisms failed to grow in the calves' rumens unless a high proportion of the feed eaten consisted of roughage.

So far no detrimental effects have been attributable to the giving of the organisms to calves, even as young as 5 days of age. In fact, under the conditions of the experiments there appeared to be considerable benefit from this procedure.

Calves whose rumens were inoculated with organisms from cow cuds and which were fed moderate quantities of milk and good quality hay alone were better in genéral appearance than uninoculated calves on similar feed. The inoculation apparently was of especial benefit to calves on this ration as regards to the vitamin C blood levels. The average blood vitamin C level of these calves was higher during the first 6 weeks of age than that attained in the calves on any of the other rations used.

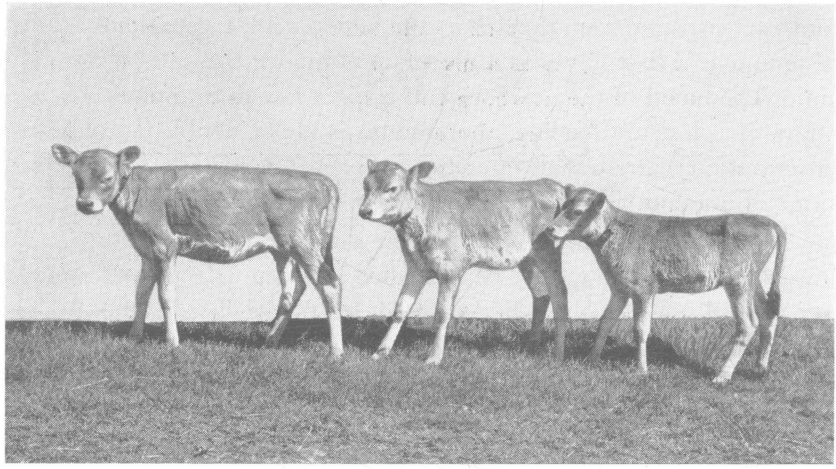

Fig. 5.—Note general health and thriftiness of rumen-inoculated calves fed on hay and milk.

It was interesting to note that while the incidence of diarrhea in the various groups of calves studied was not affected by the giving of cud materials, it appeared to be influenced by the feeds available to the calves. The calves on milk and hay did not suffer any attacks of sickness during their first 6 weeks of age. However, the incidence of diarrhea was in excess of 50 percent in the groups of calves receiving various proportions and types of grain mixtures and those receiving milk alone.

W. D. Pounden and J. W. Hibbs

Calf Rations Influence Blood Vitamins

Preliminary investigations indicated that the development of the rumen in young calves is influenced by the type of ration fed. Experiments were conducted to determine the effect of different rations and early rumen development on the levels of vitamin A, carotenoids, and ascorbic acid in the blood.

Rumen inoculations, accomplished by direct transfer of cud material from cows in the herd to the calves, were supplied to about one-half the calves in order to make certain that they had access to the microorganisms typically observed in the rumens of adult animals.

Rumen inoculations were effective in preventing the usual drop in blood plasma ascorbic acid between the seventh and fourteenth days of age when only alfalfa hay and milk were fed, but were ineffective when

grain was included in the ration. Rumen inoculations had no marked effect on the blood carotenoid levels. However, a ration of milk and alfalfa hay alone resulted in carotenoid levels considerably higher after 14 days of age than was observed when grain was included in the ration.

Neither rumen inoculations nor the type of ration fed influenced the blood plasma vitamin A. Liver storage would need to be determined in order to measure the full effect of either the ration or rumen inoculations on vitamin A metabolism.

When grain was introduced into the ration on the sixty-fourth day of age of calves which previously had been fed only alfalfa hay and milk, a marked reduction in hay consumption, blood carotenoids, and ascorbic acids resulted.

These results, when correlated with the effect of different rations on the kinds and numbers of various rumen microorganisms in young calves, emphasize the importance of palatable high quality hay in meeting the vitamin needs of calves through the establishment of early rumen function.

J. W. Hibbs and W. D. Pounden

Rye Pasture Increases Milk Vitamin A

Two groups of cows were fed a ration of corn silage, alfalfa hay, and grain. Beginning in November, 1947 one of these groups was barn-fed on this ration throughout the experiment, while the other group, in addition to this ration, was allowed to graze rye pasture for a brief period on days when the weather was suitable. Due to the severity of the winter, the cows in the grazing group were not pastured as much as had been expected.

The carotene and vitamin A content of the milk in the preliminary period was 1,668 U. S. P. units vitamin A activity per liter for the control group and 1,778 units per liter for the pasture group.

By November 25, cows in the control group had decreased to 1,382 units per liter, while the group which had received 95 hours of pasture during this period had increased to 2,343 units per liter. In the last week of January, the control group had further decreased to 1,009 units per liter and the other group which received only 17 hours on pasture, decreased to 1,176 units per liter.

During the months of April and May of this year, another group of cows was divided, one group being barn-fed and the other turned out to limited grazing. The cows in the grazing group were on pasture nearly every day during this period.

Fig. 6.—Rye pasture April 26, 1948, showing growth of early spring rye pastures after intermittent and limited winter grazing.

The vitamin A activity of the milk from these cows before pasturing was as follows: the control group, 723 units per liter and for the group to be pastured, 721 units. In May when the milk was again sampled, the control group had a vitamin A activity of 921 units while the pasture group had increased to 1,350 units per liter.

R. G. Washburn and C. F. Monroe

Quick Test for Brucellosis

Danish investigators have recently reported on a simplified milk test whereby it is possible to identify Brucellosis infection in a herd by tests made with composite milk samples from the herd.

The simplicity of the test and the possibility of determining infection in a herd by a single test of the herd milk may offer a means of establishing the presence of infection in area control measures that will be of unusual value. Work at present is being done to ascertain the limits of its use both as an individual animal and herd test.

In critically controlled tests, the results prove highly encouraging. However, considerable work need yet be completed before final conclusions can be presented.

B. H. Edgington, Norma Frank, W. D. Pounden, J. H. Helwig, and W. E. Krauss

Livestock

Study New Brucellosis Test

Results of the agglutination (blood) test as used in the attempted control of bovine Brucellosis do not afford differentiation between the actually infected animal and one that may have been exposed and has recovered from the infection. Also, the use of Strain 19 vaccine causes disturbing blood reactions which cannot be distinguished from those produced by actual infection.

In 1947 Dick, Venzke, and York reported results obtained by a new method of test that gave promise of being capable, under certain conditions, to differentiate between the infected and non-infected cow. Work is now being conducted to further establish the reliability of the test and its field of use.

Tests of this procedure are being made on available farm herds and in groups of animals under laboratory control conditions. This work is as yet too incomplete for definite report but present indications are that the test will be a worthwhile contribution to the control of bovine Brucellosis.

W. G. Venzke, John N. Buker, and Nelson B. King

Bacteria Useful to Ruminants

Examinations were made of the large numbers of bacteria inhabiting the forestomach of cattle and sheep. These microorganisms are known to aid ruminants in digesting roughages and supplying certain vitamins and key amino acids. In studying rumen bacteria in different groups of animals particular attention was focused upon the feed and management conditions which paralleled Ohio farm practices.

The animals studied included fattening cattle and lambs, dairy and beef cows on both winter and pasture rations, and ewes fed in the barn and again on pasture. Different breeds within a given species of animal were used. Some animals received either corn or hay silage while others received no silage.

The types of rumen organisms found in both species of animals were rather similar. More fast-growing organisms were noted with grain feeding in both cattle and sheep. The number of organisms averaged

about 50 million per gram in the rumen of both species when fed various winter rations. Somewhat higher numbers of organisms were found when animals were on pasture.

L. S. Gall, Wise Burroughs, B. H. Edgington, and Paul Gerlaugh

Protein Essential to Roughage Utilization

Protein supplements in cattle rations often increase roughage digestion. The need for supplemental protein is highest when low-protein roughages are fed or when large amounts of starchy grains such as corn are fed along with roughages.

The importance of supplying sufficient protein in livestock rations for purposes of building body tissue and animal body products is well known. Protein in cattle rations serves an additional purpose, namely, the digestion of roughages consumed by these animals.

The method by which protein aids roughage digestion is apparently through the action of bacteria normally found in the paunch or rumen of cattle. These bacteria require protein. When they grow they secrete enzymes which in turn digests the fibrous portions of roughages.

Experimental cattle rations were fed which contained an extremely low amount of protein and were compared with the same rations to which protein had been added. Roughage digestion increased as much as two-fold with the additional amounts of protein. The number of bacteria found in the paunch increased somewhat similarly to the increase in roughage utilization.

Wise Burroughs, L. S. Gall, Paul Gerlaugh, and R. M. Bethke

Steers on Silage Utilize Corncobs in Ration

This past year at the Madison County Experiment Farm three lots of steers were fed 25 pounds of corn silage per steer daily, 1½ pounds of soybean oil meal, and a full feed of hay (which amounted to 3.5 to 4 pounds) per steer per day.

One lot of steers was fed ground shelled corn, one lot was fed regular corn-and-cob meal, and the third lot was fed a corn-and-cob meal made by adding 20 pounds of ground cobs to 100 pounds of the regular corn-and-cob meal.

The ground shelled corn-fed lot out-gained the other two lots by a slight margin. They outdressed the corn-and-added cob meal lot by one-half percent.

Fig. 7.—Corn-and-cob meal put a good finish on this lot of cattle.

Cob replacement values, in terms of shelled corn, for both the regular corn-and-cob meal and the corn-and-added-cob meal were as high in this test, which used half a full feed of corn silage, as obtained in Wooster tests where silage was not a part of the ration. This has amounted to cobs being worth one-half their weight in terms of shelled corn.

Paul Gerlaugh, H. W. Rogers, and M. A. Bachtell

Soybean Oil Meal Affects Cob Utilization in Steers

Work was done to determine whether the quantity of protein concentrate (soybean oil meal) fed to yearling steers was responsible for increasing cob replacement values in terms of the shelled corn and soybean oil meal portion of the ration.

One lot of steers was full-fed ground shelled corn and about 1½ pounds of soybean oil meal daily per steer. Four lots of steers were full-fed corn-and-added-cob meal. The amount of cobs added was the same as in the original ear corn used.

One of these lots was fed 1 pound daily per steer of soybean oil meal throughout the 196-day test. Another lot was fed 2 pounds daily, and a third lot was fed 3 pounds daily per steer. The fourth lot on corn-and-added-cob meal was fed 1 pound daily during the first 56 days on test,

then 2 pounds daily for 56 days, and were raised to 3 pounds daily during the last 84 days of the test. All lots were given what mixed hay they wanted.

Steers getting 2 pounds of soybean oil meal gave higher replacement values to the cob portion of the ration than when 1 pound of soybean oil meal was fed. The steers getting 3 pounds of soybean oil meal gained more rapidly than those getting 2 pounds but the cob replacement values were lowered.

The results indicate that 1 pound of soybean oil meal is minimum, perhaps below minimum, and 2 pounds of soybean oil meal per steer per day is maximum for use in a corn-and-added-cob meal ration for steers.

Paul Gerlaugh, Wise Burroughs, and L. E. Kunkle

Beef Crossbreds Compared with Purebreds

The seventh crop of calves on this test comparing purebred Angus and purebred Herefords and the crosses, both ways, were calved in the fall of 1946, weaned in April 1947, grazed during the summer of 1947, and full fed corn-and-cob meal, along with 1½ pounds of soybean oil meal, 5 pounds of corn silage, and what mixed hay the calves wanted during the winter and then were slaughtered in late March 1948.

The purebred Angus calves had shorter gestation periods than the purebred Hereford calves, while the crossbreds were intermediate in this respect. Calves from the Hereford cows were larger at birth than the calves from the Angus cows. The crossbred calves from Angus cows were heavier at birth than the purebred calves, though the crossbreds from the Hereford cows were lighter in weight at birth than the purebred Hereford calves.

Average daily gains from birth to weaning were higher in the case of the calves from the Angus cows. This may be associated with milking qualities. Calves from Hereford cows gained more on pasture than the calves from the Angus cows. A part of this increased performance on pasture was probably due to their being thinner in flesh when they went on pasture.

In the 168-day stay in the feedlot, the purebred Hereford calves outgained the crossbreds and the purebred Angus calves, and used less feed in making the gains. The crossbred calves outdressed the purebreds but did not show any appreciable advantage in carcass grade. The increased size of the Hereford breed probably shows in the results, as well as hybrid vigor.

Paul Gerlaugh, D. C. Rife, and L. E. Kunkle

Good Results from Three-breed Crosses of Sheep

For a number of years the Merino sheep industry of Southeastern Ohio has been in marked decline due, primarily, to changed economic conditions which make it unprofitable to keep sheep for wool alone, and thus make the market lamb an essential feature of any sheep enterprise.

In this grain-short area, the straight-bred Merino seems unprofitable under modern requirements, partly because the ewes have not been developed for high fecundity, partly because the lambs have not been developed in carcass form, and especially because the lambs are of a slower growing type which require wintertime grain feeding to put them in market condition.

To develop a profitable system of sheep production for this pastoral region, tests have been under way at the Southeastern Experiment Farm since 1941 involving 11 groups of ewes, which, bred to rams of several breeds, have produced 27 types of lambs as represented by the different breeds, grades, and crosses. Two systems of breeding and production are showing considerable promise of being the basis for a renewed and profitable sheep enterprise in the area.

At the head of the list is a home-produced, crossbred type of ewe developed by mating Merino ewes to rams of a large breed, such as Columbia, and then mating this crossbred type of ewe to one of the larger type mutton breeds, such as Hampshire or Suffolk. The hybrid vigor which seems to accrue under this three-breed crossing system apparently increases the number born, contributes to good livability, and hence provides more pounds of lamb to sell. The crossing of the native Merino to the large type Columbia and then to large type mutton rams has resulted in lambs that grow rapidly and are more nearly ready for sale off grass than any other type produced in the tests. The other type of sheep showing good promise is the imported, western ewe of the white-faced, tight-fleeced type bred to large-type rams of the mutton breeds.

D. S. Bell and L. E. Kunkle

New Zealand Merino Ram Used on Native Merinos

With the recent importation to the United States of a flock of strong-wooled, or so-called "robust fleece" type of New Zealand Merino, much interest has developed in the subject of what results will follow from the crossing of this type with the smooth-bodied type of American Merino.

Upon the request of the American and Delaine Merino Record Association, the Ohio Experiment Station undertook some exploratory matings using a New Zealand (strong-wooled) Merino ram on the smooth-bodied American Merino ewes.

The progeny from the first mating reached shearing age in April, 1948. The shearing records show that the female progeny sired by the New Zealand ram averaged 3.6 pounds heavier fleeces that were 0.7 inches longer in staple than the fleeces from the smooth-bodied American type ewes raised for comparison. The cross-bred type averaged 15 pounds heavier in body weight than the ewes with which they were compared. Because the New Zealand Merino ram carried a much coarser fleece (grading 62's) than the American type (grading mostly 70's and 80's) the wool from the crossbred type averaged several spinning counts coarser than the American-type fleeces.

Fig. 8.—Shown on the left is a New Zealand ram and on the right is a native Merino.

From the standpoint of growth rate and size of sheep and weights of grease wool at shearing, the initial crosses are of much interest. From the standpoint of keeping fineness of fiber, there may be some question as to infusing the new type too freely until more than a single group of the crossbred type have been studied.

D. S. Bell

Infant Mortality in Lambs A Breeding Problem

An analysis of records covering infant mortality among lambs showed that about 20 percent of the ewes in the flock were responsible for about 80 percent of the total mortality that occurred.

When the mortality was analyzed from the standpoint of the ram siring the lamb, it was found that the ability of the rams used to sire lambs that would live varied all the way from no mortality to 72 percent infant mortality in the progeny of the ram. This indicated that much of the infant mortality was traceable in some way to breeding.

Further analysis of the records from the standpoint of whether each death was attributable to inherent defect among the parent stock or inherited defect in the progeny, as compared with the deaths arising from outside cause, showed that 72 percent of the infant mortality among one breed and 75 percent among another breed was traceable to qualities having a genetic basis.

To gain further information, an inbreeding, outbreeding, and crossbreeding experiment was set up under the thesis that if much of the infant mortality was arising from a genetic background, inbreeding should cause it to show in a more pronounced manner.

The results from the first inbreeding tests show that within one breed the infant mortality rate among the outbred and crossbred progeny was 13.8 and 14.2 percent, respectively, while among the inbred group 42 percent failed to survive the infant stage of life. Within the other breed, 28 percent of the outbred progeny died in infancy while 40 percent of the inbred group died at birth or within 2 months.

Apparently much of the infant mortality among lambs arises from inherent defect among the parents or inherited defect among the progeny. Reduction of infant mortality, therefore, is largely a breeding problem.

D. S. Bell

High Protein Not Harmful to Pigs

Four groups of pigs fed rations containing (1) 10 percent of protein for the entire time, (2) 16 and 10 percent of protein during the growing and fattening periods, respectively, (3) 16 and 14 percent or standard amounts of protein during the growing and fattening periods, respectively, and (4) 20 percent of protein for the entire time varied in rapidity and efficiency of gains with the amount of protein in the ration.

The standard ration produced gains over twice as rapidly and on about half as much feed per unit of gain as the one containing no protein concentrate—that is the 10-percent protein ration. Besides gaining slowly and inefficiently, the pigs without a protein concentrate became thin-haired and rough-skinned. The pigs were in dry lot and were carried from approximately 40 to 210 pounds in weight.

Pigs fed a 40-percent protein ration for the entire time made less rapid and less efficient gains than those fed the 20-percent protein ration. The looseness of the bowels of the pigs in the different groups varied with the amount of protein in the ration.

Apparently, the laxative condition had no harmful effect on their health or performance. Nor were any seriously ill effects from feeding relatively high levels of protein observed. As judged by the health and excellent performance of the pigs on the 20-percent protein ration, certainly more protein than is called for by feeding standards can be fed with safety.

Slaughter data were secured. As the rations increased in protein the total dressed yields decreased. On the other hand, the percentage of fat cuts and fat trimmings decreased, whereas the percentage of lean cuts increased.

The total lean cuts from the hogs on the 10-, and from those of equal weight on the 20-percent protein ration averaged 46.5 and 56.1 percent of the carcass weights, respectively. The fat trimmings and the total fat cuts averaged 24.5 and 47.3 against 17.1 and 36.5 percent of the carcass weights, respectively. The pigs fed the larger amounts of protein also had heavier (that is larger) livers, hearts, kidneys, and spleens than those fed the smaller amounts.

W. L. Robison, L. E. Kunkle, and B. H. Edgington

Niacin Needed in Pig Rations

Further studies with pigs kept indoors and fed rations deficient in niacin resulted in unthrifty pigs which showed a marked tendency to scour. Niacin deficiency developed in weanling pigs approximately one

month after being placed on the experimental ration. Pigs fed the same ration but with niacin added, gained very satisfactorily with no signs of diarrhea.

B-vitamin deficiencies most often occur in pigs raised in confinement without access to pasture. Low protein rations are subject to B-vitamin deficiencies unless good vitamin supplements are supplied such as pasture or high grade legume meal.

Wise Burroughs, B. H. Edgington, W. L. Robison, and R. M. Bethke

Methods of Feeding Pigs on Pasture

An experiment on methods of feeding on pasture included five groups of 20 pigs each. The pigs were carried from approximately 52 to 220 pounds in weight. The pasture was alfalfa, from which the first cutting had been removed. Corn and a supplemental mixture of meat scraps, soybean oil meal, and minerals were fed.

The supplement for one group was pelleted and mixed with shelled corn and the mixture was self-fed. The amount consumed by them and by a group self-fed non-pelleted supplement and shelled corn separately averaged 10.7 and 8.6 percent of their respective rations. The pigs having the mixture containing the pellets gained only a trifle faster but required 5.1 percent less feed per unit of gain than those self-fed the corn and supplement separately.

Fig. 9.—Good pasture is an excellent feed for hogs.

A group full-fed ear corn plus 0.25 and 0 30 pound of supplement a head twice daily before and after they averaged 120 pounds in weight, respectively, gained more slowly, were not ready for market until 8 days later but, with the cob deducted, required 10.7 percent less feed per unit of gain than the group self-fed shelled corn and supplement, separately. They were given 16.9 percent less feed daily a head than was taken by the self-fed group.

Pigs full-fed a mixture of ground shelled corn and supplement twice a day ate almost as much feed, gained practically as fast and required within 2.2 percent as much feed per unit of gain as those self-fed shelled corn and supplement separately. Their pasture was less plentiful than that of the group fed ear corn and possibly also than that of the self-fed group.

The fifth group received the same ration as the fourth but was self- rather than hand-fed. They ate more feed, gained faster, were ready for market 11 days earlier, and required 4.9 percent less feed per unit of gain than those self-fed shelled corn and supplement separately. They were ready for market 19 days earlier but required 6.6 percent more feed per unit of gain than those fed ear corn.

W. L. Robison

Solvent-extracted Cottonseed Meal for Pigs

Earlier tests showed that a detoxified cottonseed meal was a less effective supplement to yellow corn, ground alfalfa, minerals, and irradiated yeast for pigs in dry lot than was soybean oil meal.

In an experiment during the year in which a low free-gossypol, and therefore supposedly non- or only slightly toxic, solvent-extracted cottonseed meal was used with such a ration, additions of (1) dried blood, (2) dried distillers' solubles, (3) a combination of condensed fish solubles and dried blood, (4) a combination of dried distillers' solubles and dried blood, and (5) a combination of dried distillers' solubles and 60 percent protein meat scraps ranked from poorest to best in the order named in increasing the rapidity of the gains and the amount of gain per unit of feed consumed. Adding condensed fish solubles to the combination of dried distillers' solubles and dried blood brought about no further improvement.

The pigs having the cottonseed meal and those having soybean oil meal with corn, dried distillers' solubles, alfalfa, minerals, and irradiated yeast gained 1.19 and 1.42 pounds daily a head and required 402 and 365 pounds of feed for each 100 pounds of gain produced, respectively.

No pigs died. After 6 weeks some developed rough, scabby skins posteriorly and ventrally. In some instances the condition persisted but it was not as pronounced during the latter part of the test or after the percentage of cottonseed meal in the ration was reduced, as it was earlier. The pigs were Durocs. By the twenty-third week, one pig on the basal and three on the ration to which condensed fish solubles and dried blood were added developed some white hair among the red. No melanotic tumors were present to cause the change.

W. L. Robison

Poultry

Fig. 10.—Lime is scattered over the surface of the litter and mixed into it thoroughly. Then 1 to 2 inches of fresh litter may also be scattered over the top. This procedure is repeated when it becomes necessary as judged by the condition of the litter.

Quick Versus Hydrated Lime for Floor Litter

The use of hydrated lime in connection with built-up floor litter has become a widely accepted procedure. A new angle is the use of pulverized quicklime. This product is now available in sealed bags at about

the same price as hydrated lime and has the advantage of being more conveniently applied and mixed into the floor litter with less dust because it is more granular. Moreover, the quicklime has a greater capacity for absorption of moisture and generates more heat which aids in drying the litter.

In January and February, 1948, moisture tests showed the average percentage moisture contents of built-up floor litter to be as follow:

Litter without lime	39.7
Litter treated with hydrated lime	39.1
Litter treated with the same amount of pulverized quicklime	33.2

The quicklime, having a greater calcium content than hydrated lime, would have a further advantage where the floor litter is used for fertilizing soil which also needs lime.

D. C. Kennard and V. D. Chamberlin

Free-choice Feeding of Whole Oats Versus Whole Corn

A new angle in the feeding of layers is the free-choice feeding of whole oats and a 24 percent protein mash.

In previous experiments the free-choice feeding of whole corn and whole oats and a 24 percent protein mash proved less satisfactory than a 17 percent protein, whole oats-mash, complete feed mixture which contained 20 percent whole oats. This suggested that the free-choice feeding of whole oats alone might be preferable, especially since a tendency was evidenced for the layers to eat too much whole corn.

Of the three rations and methods of feeding, the Leghorns which received the free choice of whole oats and 24 percent protein mash laid the most eggs (179 per bird) in comparison with 165 and 171 eggs per bird from the groups that received the free choice of whole corn and oats and the whole oats-mash mixture.

While the Leghorns did a good job of balancing their ration with a total protein intake of 17.1 percent when given the free choice of whole oats and a 24 percent protein mash, they failed to do so by eating too much whole corn when given the free choice of whole corn and oats and mash with a total protein intake of only 13.9 percent.

As in previous experiments the Rhode Island Reds did a poor job of balancing their ration (total protein intake, 12.7 percent) when given the free choice of whole corn and oats. However, they did a better job when given the free choice of whole oats with a total protein intake of 14.7 percent.

Judging from these results and the results of previous experiments, it appears that whole oats—preferably as a whole oats-mash mixture—may be successfully used as the only whole grain in addition to the mash for feeding layers.

D. C. Kennard and V. D. Chamberlin

Search for Chick Growth Factor in Animal Proteins

Sardine fish meal and condensed fish solubles contain a factor (s) essential for optimum growth and feed utilization in chicks fed a ration in which soybean oil meal serves as the only source of supplemental protein. This unidentified factor (s) in fish products was previously reported in preliminary investigations to be soluble in hot water, 60 or 80 percent ethanol, and 50 percent acetone.

Further work on the isolation of this growth stimulant from sardine fish meal and condensed fish solubles indicated that the unknown factor (s) was insoluble in ethyl ether and n-butyl alcohol; was destroyed by severe acid hydrolysis but not by mild acid hydrolysis; was stable to air and light and not destroyed appreciably by heating for long periods of time at 80° C.; was not destroyed by storage in the cold at freezing temperatures; was adsorbed from a water solution at pH 3.0 by the activated charcoal, Darco G-60, but not adsorbed from an 80 percent ethanol solution at pH 3.0; was eluted from Darco G-60 by 10 percent ammonium hydroxide in 95 percent ethanol with about 20 percent loss of activity; and was colorless.

In preliminary investigations it was reported that 2 or 3 percent of sardine fish meal or condensed fish solubles in the soybean oil meal rations gave the greatest response in growth and feed utilization. The factor (s) essential for this optimum growth was concentrated to the extent that addition of 36 grams per 100 pounds of the ration (0.126 percent of the ration) exerted approximately a maximum growth response. Further purification remains to be accomplished before chemical structure experiments are conducted.

J. M. Pensack, R. M. Bethke, and D. C. Kennard

Hen's Diet Influences Growth of Progeny

The quantity of several known vitamins deposited in the egg by the hen exerts an important influence on the subsequent growth and viability of the chick. This effect was observed on certain practical diets containing adequate quantities of all known vitamins by irregularities in

chick growth which was corrected by the addition of sardine fish meal or condensed fish solubles to the hen's ration. The growth factor (s) present in these fish-product supplements apparently was transmitted from the hen through the egg to the chick.

Concentrates of the unidentified growth factor (s) present in sardine fish meal and condensed fish solubles and which were known to increase growth when fed directly to chicks were incorporated in the hen's ration and similar growth responses were obtained with the chicks indicating vitamin-like characteristics of the unidentified factor (s). These experiments also indicate that the unidentified growth factor (s) is soluble in 80 percent ethanol and can be adsorbed from a water solution on Darco G-60 at pH 3.0.

Addition of 4 percent sardine fish meal to the chick ration caused a significantly greater increase in growth in chicks from hens fed no animal-protein supplements than in chicks from hens fed a fish-products supplemented ration. Furthermore, chicks fed the sardine fish meal supplemented ration grew equally well, irrespective of whether their dams were fed a fish-product supplemented ration or not.

The results emphasize the important of giving consideration to the breeder diet as a factor in the performance of chicks on experimental or practical diets.

J. M. Pensack, R. M. Bethke, and D. C. Kennard

Soil Management

It Paid to Treat Soil Well

Since 1934 most of the plots in the soil fertility tests on the outlying experiment farms have been adequately limed. Manure has been applied in varying amounts, but all fertilizer used has been at the rate of 150 pounds per acre on corn and 300 pounds on oats or wheat—a total of 450 pounds for the rotation. The value (per acre, per year) of increases averaged for 10 farms over the 14-year period, 1934 to 1947, is given below.

Treatment	Value of increase
9.2 tons of manure	$12.67
450 pounds of 0-20-0	14.00
450 pounds of 0-14-7	18.16
450 pounds of 2-12-6	18.24
7 tons of manure and 450 pounds of 2-12-6	24.91
7 tons of manure and 450 pounds of 0-20-0	25.37
13.7 tons of manure and 450 pounds of 0-20-0	26.50

M. A. Bachtell

Plowing Sod for Corn Still Best

An experiment has been conducted for the past 10 years to compare different methods of preparing sod land for corn. Such long-time results are valuable because the effects of unusual seasons are minimized in the average.

The rotation followed is a 3-year rotation of corn, wheat, mixed hay. Six different tillage methods are used in preparing the sod land for corn. The treatments and the 10-year average corn yields are:

Treatment	Av. yield (bu.)
Normal preparation (plowing, discing, leveling)	49.8
Minimum (furrow slice completely inverted, little or no seedbed preparation)	49.4
Rotary tillage	44.7
Subsurface tillage (large sweeps at 7 inches—soil not turned)	41.3
Surface only (discing—only top 3 to 4 inches worked)	37.1
Normal, plus heavy straw mulch at first cultivation	52.0

It can be seen that those treatments which have included plowing have been significantly better than those where the land has not been plowed. The favorable yield obtained with the minimum seedbed preparation suggests that many farmers may waste time and effort in making a fine seedbed for corn.

Observations at time of seedbed preparation have led to the conclusion that rotary tillage may overdo preparation in that it tends to break the soil down into a finely pulverized seedbed. The yield figures tend to support this conclusion. Where erosion control is not of such importance that residues have to be left on the surface for protection it would appear that plowing is still the best method of those tried of preparing sod land for corn.

J. B. Page, C. J. Willard, R. L. Erwin, and G. W. McCuen

Availability of Potassium from Soil Minerals Varies

The rates of release of potassium from minerals of the major soils of Ohio have been studied in greenhouse experiments during the past 2½ years. Over the duration of this experiment, 21 successive cuttings of alfalfa were removed from Wooster silt loam which had received no potassium fertilizer. It was found that the average rate of release of potassium from soil minerals (non-exchangeable forms) was 33, 60, and 75 pounds per acre per year when the soil was limed to pH 6.0, 6.8, and 7.3 respectively. In comparison to the Wooster soils, Clermont silt

loam, Miami silt loam, and Trumbull silty clay loam released non-exchangeable potassium respectively at a rate of 20, 30, and 43 pounds per acre per year. The latter soils were limed to neutrality.

Yields of alfalfa were increased on all soils when potash was applied as fertilizer. Under the conditions of this experiment, fertilizer applications of potash as high as 115 pounds per acre per year gave yield increases. The results indicate that soils which release high amounts of potash from soil minerals require less potash as fertilizer for optimum yields. Complete liming appears to increase this release rate or availability of non-exchangeable potash to alfalfa.

C. E. Evans, R. H. Simon, and G. W. Volk

Important to Satisfy Limestone Needs

The value derived from an adequate liming program has amounted to an average of $34.11 per acre per year at the Trumbull County Experiment Farm where the unlimed soil has a pH of about 4.5. Valuations used were $1.25 per bushel for corn, $1.75 for wheat, $0.80 for oats and $15.00 per ton for hay.

The low mark has occurred in the glaciated area as represented by the Hamilton, Madison, and Miami County Experiment Farms. The average increase on those farms has been valued at approximately $1.00 per acre per year, an amount scarcely large enough to cover the cost of liming.

Other areas of the state are intermediate, with the Clermont, Washington, and Belmont Farms showing increased values varying from $11.08 to $24.22 per acre per year. It is important to satisfy the soil needs for limestone.

M. A. Bachtell

New Method for Determining Lime Needs of Soil

A method for determining the exchangeable hydrogen or residual capacity for calcium absorption of a soil was studied. This determination is most commonly made by adding calcium hydroxide to the soil followed by carbonation, then by aeration. The soil treated in this manner is subjected to drastic pH shifts and furthermore there is a tendency toward a build-up of exchange capacity when the soil is made alkaline.

To avoid these undesirable shifts, an equilibrium pH of 7.0, which is approached from the acid side only, is being studied for the soil-calcium bicarbonate-air system by substituting neutral 0.2 molar calcium chloride solution for water. A solution of 0.004 molar calcium benzoate

is also added to inhibit biological action. When the details of this method are completed, use of the method can be made in determining the lime requirement of soils.

C. J. Schollenberger

Specific Surface of Liming Materials Vary

Measurements of surface on liming materials have been made on a number of commercial limestone meals, using the oxalate absorption method. The results show that the average No. 8 meal has a specific surface of 20 to 23, while the No. 10 meals all run above 30, indicating a specific surface 50 percent or more greater than the No. 8.

Measurements were also made on sieve fractions of both dolomitic and high calcitic stones. In the case of dolomitic over 8 and under 20 mesh which had not been washed to remove adhering dust the specific surface was 9.4. After washing to remove the adhering dust the specific surface was reduced to 5.9. With the high calcium fraction of over 8 and under 20 which had not been washed the specific surface was 3.5 and after washing was reduced to 2.0. Microscopic examinations showed the dolomitic material to have flat-shaped particles whereas the particles of the calcitic material were more rounded.

Surface measurements have also been made on several slag liming materials. Representative results indicate that water-quenched slags (1943 sample) have higher specific surfaces than similar type materials of 1926. The specific surfaces of these materials were respectively 31.0 and 13.4. In comparison to a specific surface of 31.0 for water-quenched or granulated slag, an air-cooled slag of equivalent sieve fineness has only 21.5 in this respect.

E. E. Barnes, C. E. Evans, and G. W. Volk

Granulated Slag a Good Liming Material

One year's results have been obtained using an alfalfa-timothy mixture in field tests on Wooster silt loam designed to compare the agricultural value of three types of liming materials of three different size grades. The liming materials used were air-cooled slag, granulated slag, and dolomitic limestone; the size grades consisted of screenings, meal, and ground material.

It was found that there was a marked increase in hay yields from all liming materials over the check. The hay yields show increases with the higher rates of application and with increasing degree of fineness. With

Fig. 11.—Background—addition of blast-furnace slag resulted in luxuriant growth of alfalfa. Foreground—check plot received no liming material.

comparable fineness, the granulated slag showed yields comparable to those of dolomitic limestone. The superiority of granulated slag over air-cooled slag was shown.

C. E. Evans, Robert G. Harding, and G. W. Volk

Measure Tile Drainage Runoff

Preliminary studies were made of tile runoff in April and May. The measurements were taken on a tile drainage system covering 21 acres of a Crosby silt loam and a Brookston silty clay loam soil. The tile were laid at an average depth of 32 inches spaced 50 feet apart in the Brookston soil and 25 feet in the Crosby patches. This area has a natural slope of 2½ percent, and the crop is mixed clover.

A runoff rate of ½-inch or more in 24 hours was recorded in the tile for one 60-hour period, and peak rates of 1.04 inches and 0.98 inches for very short periods. The maximum rate occurred following a 3-day cumulative rainfall of 2.10 inches; the second rate was recorded one day

later with an additional rainfall of 0.77 inches. During this time there was no observable surface runoff from the area in spite of the slope of the land and amount of rain.

It is interesting to note that the excessive runoff rates occurred in a very short period of time (2 days) and rapidly decreased (in less than 24 hours) to a rate below ¼-inch in 24 hours. The greater part of the time, the runoff remained below ⅛-inch in 24 hours. There was only ½-inch of rain in the last half of April followed by 2.10 inches in the first week of May. The runoff rate did not exceed ⅛-inch even in the first week of May. The present general recommendations for design of tile drainage systems in Ohio assume a tile runoff rate of ⅜ inches in 24 hours.

Once the soil is thoroughly wetted, there seems to be a close correlation between the time of rain and the time of tile runoff.

Virgil Overholt and H. M. Gitlin

Clark County Soil Survey Completed

During the past year, the field work has been largely completed for the soil survey of Clark County. The map and report for that county is being prepared for publication. A soil survey of Fairfield County has been initiated, and a field party of four men will devote their time to that county during the 1948 field season. The soil survey maps and reports for two previously mapped counties, Tuscarawas and Huron, are expected to be available in the near future. The Experiment Station is cooperating with the U. S. Department of Agriculture in the soil survey program.

The state soil survey program has been expanded by the addition of three new men to the force.

Further important studies are in progress in connection with the soil survey program. The minerological composition of several important Ohio soils is being studied in order to give us a better understanding of the mode of formation and the physical and chemical properties of these soils. Another project involves the study of permeability and related characteristics of several major soil types. The above mentioned studies will serve to supplement and clarify the field studies of the soil survey.

D. D. Mason

Silage

Test New Devices for Silage Protection

Recently designed and built types of seals for exposed silage surfaces have almost completely excluded air, with the result that air-caused spoilages have not developed under these seals.

The devices take various forms to accomplish the mechanical exclusion of air. There is a water and airtight sheet over the shaped surface of the chopped forage. It extends to the wall, with enough to spare to go up the silo wall and form the seal there to keep out all air.

Some have an air-inflatable rim which rides on the pond of water that may cover the whole surface, and push the edges of the cup out to the wall and upward along it far enough to seal out the air.

Others are in two pieces; the first a blanket that lies over the whole crowned surface follows it to the bottom of a ditch at the wall, then comes up along the wall for the necessary contact. The second piece is

Fig. 12.—The operator is placing the tube against the silo wall to get a good fit.

a tube made of plastic material which lies in the ditch atop the blanket. When filled with water it fills the ditch, and presses the sheet against the wall.

Each design is about equally effective. The second has advantages of being easier to put on, and remove. It is also simpler to make.

All materials are reasonably durable to the conditions imposed by silage on one side and weather on the other. It is well to remove water from these sealing devices before it freezes, as cold and ice together may damage the sheet plastic.

The B. F. Goodrich Company of Akron has cooperated in designing the sealing devices and helping with the work of testing.

Charles F. Rogers

Silage Cap Reduces Surface Spoilage

The sheet plastic devices that mechanically exclude air from silage surfaces have proved to be good for grass silages as well as corn, although most of the completed tests have been on corn. Grass silages need seals worse than do corn because of the longer storage time for them.

A 52-day test with grass silage in an 8-foot silo showed 183 pounds of undesirable material, and a 70-day test with similar material in an identical silo had 360 pounds spoilage, most of which was at the door.

In terms of reduced spoilage and the improved silage quality of the whole topfill, the value of the device is easy to demonstrate. Even over long periods of storage, properly-installed seals on properly-filled silos, with well conditioned topfills, showed losses ranging from nothing to less than 1,000 pounds under one sealing device on a 14-foot silo for 328 days. The corn silage in contact with this water-filled pond type cup was as good as one would expect two or three doors below the upper level of good silage under normal air-caused spoilage.

Even when air exclusion is so good that no molds develop, and this has usually been the case, there is a cold wet ring at the wall, larger and more noticeable in silages made from drier forages. This material has been fed to young stock and swine, but not to milk cows. The ring is probably unavoidable in water-sealed devices of this sort, not because of leakage, but it is thought because water vapor condenses at the contact of sealing device silage and wall, which may be the coolest place in this part of the silo. Observations are now under way to learn the nature of these protected surfaces.

Charles F. Rogers

Alfalfa Silage Preserves Carotene

A field of alfalfa was divided into two parts for this study conducted in cooperation with the Ohio Farm Bureau. One part was field harvested, the crop immediately dehydrated, then ground, sacked, and stored in a barn.

The remaining part of the field was ensiled with the addition of molasses and this material kept in the silo for 6 months. It was then dehydrated, ground, and stored for a month.

The loss of carotene from the artificially dehydrated alfalfa stored in a barn was 48 percent. The carotene loss in the alfalfa that was ensiled, then dehydrated was 30 percent.

Although there was more carotene in dehydrated alfalfa silage than in the stored, dehydrated alfalfa meal over the same period of time, the physical characteristics, particularly the odor, of the dehydrated silage were such as to question the advisability of attempting to preserve carotene in this manner.

R. G. Washburn, W. E. Krauss, and C. F. Monroe

Microbiological Investigations of Silage

Eight different isolates, all yellow species of bacteria, were obtained from washings of whole leaves of alfalfa, timothy, and clover. Phages were prepared for them, using extracts of alfalfa, timothy, and clover. Some of these phages continued to develop with the organisms indefinitely, others were soon lost.

When a phage was present in some species, the secondary growth which developed produced more acid from dextrose than the original. Likewise, when a phage is removed from a silage organism, the phage-free isolate produced less acid from dextrose than the original silage organism.

R. C. Thomas

Farm Crops

New Soybean Varieties

Two new soybean varieties are being increased in Ohio in 1948. Approximately 80 bushels of a new early strain, experimentally known as H5, are being increased this year. H5 is several days earlier and stands better than Earlyana and is equal to it in height and yield. As soon as

adequate seed is available, it should replace all Earlyana acreage and some of the Richland acreage. It is early enough to precede wheat in northern Ohio.

About 5,000 bushels of Hawkeye soybeans are also being increased in Ohio in 1948. Hawkeye soybeans are as early as Richland and stand as well and yield as high as Lincoln. Hawkeye soybeans should replace considerable Lincoln acreage and most of Richland acreage. It was developed by the Iowa Experiment Station in cooperation with the U. S. Regional Soybean Laboratory.

These two new soybean varieties should net the Ohio soybean producers several dollars per acre per year over other non-recommended soybean varieties.

Lewis C. Saboe

Soybeans Respond to Delayed Applications of Nitrogen

Lincoln variety of soybeans, even though inoculated with nitrogen-fixing bacteria, responded to nitrogen when applied as a side-dress application at the time of bloom during the 1947 season on Wooster silt loam.

Increases in yield of 2.22, 3.57, and 5.50 bushels per acre were realized from delayed applications of nitrogen of 40, 80, and 120 pounds per acre, respectively. Plants receiving no nitrogen yielded 30.25 bushels per acre. Soybeans receiving the above rates of nitrogen as a broadcast, plow-down application before seeding showed little or no increase in bean yield over the check nitrogen plots.

Sampling between August 2 and September 9 showed that plow-down nitrogen increased the height but did not increase weight of plants as compared to delayed nitrogen treatments. Plants receiving side-dress, delayed nitrogen set more pods and did not lodge as soon as plants receiving nitrogen as the plow-down, initial application. The latter plants showed high initial percentages of nitrogen, but the nitrogen percentage decreased sharply with maturity, indicating inadequate available nitrogen at the time of fruiting.

C. E. Evans, J. H. Wilson, and G. W. Volk

Flax Varieties Tested in Ohio

Two flax variety nurseries were grown in Ohio in 1947, one at Wooster and one at the Marsh Foundation Farm at Van Wert, Ohio. Seed was furnished by J. O. Culbertson, Associate Agronomist in charge of seed flax investigations for the U. S. Department of Agriculture.

Because of wet weather the nurseries were late planted; in spite of this yields were very satisfactory, ranging from 12 to 15 bushels per acre at Van Wert and from 9 to 17 bushels at Wooster. These results suggest that new date-of-seeding tests with flax should be made with dates later than those used in tests made several years ago.

The 10 varieties in the 1947 tests were Victory, Crystal, Bison, Arrow, Sheyenne, 980 x Redson, Minerva, Redwing, Dakota, and Koto x Redwing. The highest yielding varieties at Van Wert were Arrow, Victory, and Redwing and at Wooster, Redwing, Koto x Redwing, and Bison. When stiffness of stem, maturity, and quality of seed are considered, Redwing and Bison were excellent.

L. E. Thatcher

Production of Foundation Timothy Seed

In order that any improved variety of timothy may be made available for use on Ohio farms, a certain process is followed. The first step in this process is the production of foundation seed from vegetatively-propagated plants, obtained by repeated subdivisions of the original plant of each selection of which the variety is composed.

This foundation seed is then sown, under approved conditions, in meadows from which registered seed is harvested. The registered seed, in turn, is used for establishing meadows for the production of certified seed.

The plants used for the production of foundation seed are obtained by subdividing older ones—preferably ones which are about 2 years old. If they have been grown under favorable conditions, about 8 to 12 new ones may be obtained from each of these plants, each one of them composed of several growing shoots with attached roots holding some soil in place.

During the latter part of October and early November, 1947, about 9,000 vegetatively-propagated plants were transplanted in rows 40 inches apart, 21 to 24 inches apart in the rows, in a 1¼-acre field at the Ohio Agricultural Experiment Station. Two timothy selections, F. C. 15167 and 28147 (of which the Lorain variety is composed) were transplanted in alternate rows which are to be cultivated during the spring months.

With this arrangement, when the Lorain selection arrives at the stage of full bloom in late June, the florets on each plant may be fertilized with pollen produced by plants of the other selection, growing in

Fig. 13.—Timothy foundation seed is produced from vegetatively-propagated plants like those shown above.

the alternate rows. After the crop produced by these plants has developed and matured, the foundation seed may be harvested with a grain binder or in some other way—just as a crop of seed would be harvested from a meadow of ordinary timothy.

Morgan W. Evans

Improved Varieties of Smooth Bromegrass are Best

Four improved varieties of smooth bromegrass, Lincoln, Achenbach, Fisher, and Elsberry, commonly known as "southern" strains, have been compared with a northern strain, Canadian No. 1, for hay at Wooster in 1947 and 1948. There was little difference in the yields of Achenbach and Lincoln in 1947 and again in 1948. In both years these varieties led in yield.

Fisher and Elsberry were also practically tied in yield in 1947 and 1948 but yielded about 10 percent less than the leaders. Canadian No. 1 was low-yielding both years, averaging about 30 percent lower than Achenbach and Lincoln. Foliage diseases were obviously cutting down the yield of the northern strain.

L. E. Thatcher

Add Ladino Clover to Pasture Mixtures

During recent years, Ladino clover has been added to most seed mixtures of legumes and grasses sown on the Experiment Station farms and intended for use as pasture, or for hay and pasture. The Ladino has greatly increased the carrying capacity of the pasture, but has not markedly increased hay yields.

Ladino clover is easy to establish and ½ to 1 pound of seed per acre in the mixture has given a satisfactory content of Ladino later in the pasture. There are about 700,000 seeds per pound. Ladino belongs in all pasture and hay-pasture mixtures except those of an annual nature. It has proven very popular and dependable under a wide range of conditions and with all types of livestock, including poultry, in cooperative tests with Ohio farmers. Ladino has not persisted long in mixtures of alfalfa and hay-type grasses where the growth has been rank and used only for hay.

D. R. Dodd

Permanent Midsummer Pasture Grasses

Timothy has for years been the standard hay grass in Ohio. We do not yet have any grass that surpasses it in hay yields, especially when it has been seeded in the fall. Fields from which hay has been removed in early June are held for pasture in midsummer and timothy is notorious for its lack of midsummer production.

Tests with different grasses have shown orchard grass, smooth bromegrass, alta fescue, and Kentucky 31 fescue all to be superior to timothy in midsummer growth. When sown in the spring crop, all of these grasses have produced better stands than timothy. The relative stands obtained, based upon orchard grass as 100 for these different grasses during the past 2 years have been as follows:

Grasses	Relative stands	
	1946 seedings	1947 seedings
Orchard grass	100	100
Alta fescue	83	55
Kentucky 31 fescue		50
Smooth brome	70	41
Timothy	55	28

Fall seedings of timothy have been very successful. Another fact that accounts in part for its popularity is its ease of seeding from the grass seed hopper of the ordinary grain drill.

D. R. Dodd

Birdsfoot Trefoil Holds Promise for Pasture Legume

A shortage of nitrogen is one of the chief reasons for low hay and pasture yields on a million or more acres of permanent sod land in Ohio. This nitrogen shortage is due to lack of sufficient legumes in the sod. Alfalfa is very exacting in lime requirement, requires a well-drained soil, and soon disappears under grazing. White and Ladino clover, although less exacting in soil requirements and more persistent under grazing, soon disappear with the hot dry weather of mid-summer in many years.

Fig. 14.—At left is a 5-year old birdsfoot trefoil plant and 30 days' growth from a piece of root left projecting from the bottom of a plow furrow 6 inches deep (right).

A legume is needed which is as tolerant to hot, dry weather as alfalfa, that will persist under grazing as well as white clover, and that will tolerate considerable range in soil acidity and soil drainage. Tests with birdsfoot trefoil under these conditions have been in progress since 1942. To considerable degree it meets these requirements.

During the past year, some progress has been made in determining the best procedure for successful establishment. It has also been observed that even when the crown of the plant has been completely destroyed, sprouts will develop from the main root below the crown and from pieces of roots projecting from the soil. These are very desirable characteristics that enable the plant to persist under grazing. Birdsfoot

trefoil establishes slowly and the seed shatters easily. These two problems of establishing stands and harvesting a seed crop, need further study before the crop can be generally recommended.

D. R. Dodd

Diseases Make Sudan Grass Unpalatable

The superiority of the new varieties of Sudan grass over the old Common variety in resistance to foliage diseases and greater value for pasture was demonstrated at Wooster in 1947. Tift, Sweet, and Common Sudan grass were grown in alternate strips in a paddock and grazed by dairy cows. During the first grazing period, all varieties were much alike in yield, palatability, and amount of herbage eaten. Foliage diseases were not serious at this time.

During the second grazing period, the foliage diseases Helminthosporium leaf blight and Anthracnose were present. Anthracnose was present on all three varieties; however, the infection was not as severe as

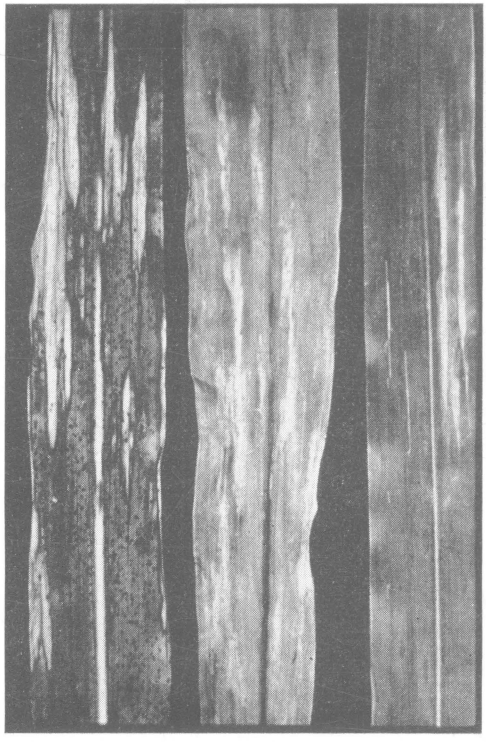

Fig. 15.—The relative susceptibility of three varieties of sudan grass to Helminthosporium leaf blight is shown to the left. Left to right—leaves of Common, Sweet, and Tift varieties.

that caused by Helminthosporium, the latter being very bad on the Common Sudan grass and relatively unimportant on the Tift and Sweet varieties.

A striking result of the infection of the Common Sudan grass with Helminthosporium leaf blight was its lack of palatability; it was scarcely touched by the cows during the second grazing period whereas the Tift and Sweet varieties were well eaten (fig. 15). Cage harvests showed that the amount of growth made by the three varieties was not significantly different during the second growth period.

L. E. Thatcher, C. F. Monroe, and R. S. Davidson

Seed Treatment to Control Victoria Blight of Oats

Greenhouse studies on the effectiveness of several seed treatment chemicals for the control of Victoria blight of oats were made on Vicland and Clinton varieties. Vicland seed known to be heavily infected with Victoria blight was used. Clinton variety seed grown in Ohio in 1947 was used.

Half of the soil was artificially inoculated with the Victoria blight organism; the remaining half was steam sterilized. Both oat varieties were treated with the same materials. The percentage stand of the two varieties on inoculated and uninoculated soil for each of the five treatments and check are given below.

Although the stand of Vicland can apparently be increased by seed treatment, it is not great enough to warrant the use of the variety. Ceresan M was the most effective material tested. Although there was no evidence of infection on the Clinton seedlings grown in inoculated soil, Ceresan M resulted in a slight increase in seedling stand.

Percentage stand of oat seedlings following treatment

Treatment	Uninoculated soil		Inoculated soil	
	Vicland	Clinton	Vicland	Clinton
Ceresan	69	91	52	95
Parsons Seed Saver	64	93	49	92
Parsons—704	63	90	43	92
Mycotox	52	92	42	91
Spergon	61	90	47	90
Check	62	94	44	92

R. S. Davidson

Wheat Scab Infection Varies With Location

The incidence of wheat scab on the varieties Butler, Thorne, Trumbull, and TN-1016-4 harvested in 1947 from 13 counties in Ohio was determined by the agar-plate method. Three replicated samples of each variety from each location was studied. The average of the replicated samples is tabulated below.

Scab infection on four varieties of wheat (percent)

County	Butler	Thorne	Trumbull	TN-1016-4
Wayne	23	16	23	23
Franklin	14	13	11	16
Trumbull	14	21	9	12
Belmont	17	26	22	23
Madison	18	21	13	18
Mahoning	24	25	20	11
Montgomery	17	17	22	21
Hamilton	21	20	22	30
Miami	31	39	35	29
Clermont	15	14	12	17
Paulding	9	6	10	5
Meigs	40	31	31	34
Henry	1	3	2	4

R. S. Davidson

Control of Seedling Diseases of Sugar Beets

Seedling disease incidence was determined on various fertilizer treatments and crop sequences. Fertilizers high in phosphoric acid reduced losses from seedling diseases. Sugar beets following legume crops were more heavily diseased than following corn. High phosphoric acid applications reduced the disease even on these plots.

H. C. Young

Slugs Injure Young Corn

During cool, wet periods in June in recent years severe injury to young corn plants has resulted from the feeding of slugs. Inasmuch as the feeding occurs only at night, farmers have not recognized the cause of the injury. In some instances, adult spittle bugs which have migrated from adjacent clover and alfalfa fields have been blamed.

The injury results in a sort of shredding of the leaves as shown in the photograph of an injured plant (fig. 16). In cases of very severe injury, the plants may be killed entirely, but in most cases the plants are merely retarded in growth and tend to recover when good growing conditions occur.

Injury is most pronounced in the wetter portions of fields in which corn follows clover or alfalfa. Under such conditions as many as 10 or 12 slugs have been found at night on a single plant. Early cultivation of the soil if followed by bright sunshine will dry out the soil surface and prevent subsequent injury.

C. R. Neiswander

Fig. 16.—Corn plant severely injured by slugs.

Drying Corn With Heated Air

During the winter of 1947-48, several cribs of ear corn were dried with forced heated air ventilation. The work was done on farm cribs in Hardin County in cooperation with the U. S. Department of Agriculture.

Although all the cribs on which tests were run were successfully dried, there is still some question as to whether heated air drying is the most practical method of drying for farm cribs. Corn just as wet as that dried by heated air was placed in cribs in the fall of 1947 and was successfully stored by using cross ventilators for natural air ventilation and by using natural forced air ventilation with a fan.

The heated air dryer used in the tests was a direct fired oil burning heater powered with a 3 horse power electric motor. The air was forced through the corn from a canvas air duct along one side. It is important to have even air distribution through the corn with no air leaks.

The fuel consumption was between 4.2 and 6.8 gallons per hour. Fuel used per 100 bushel, was 26 gallons for corn with 20.5 percent moisture and 59 gallons for corn with 25.2 percent moisture.

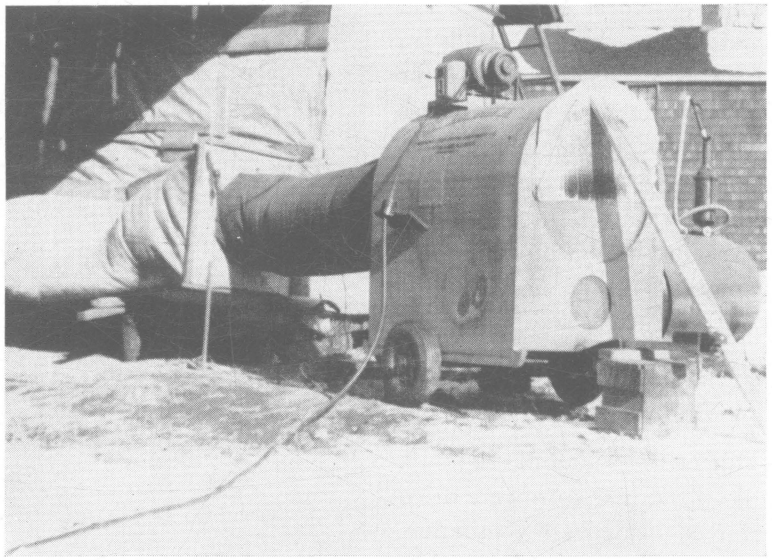

Fig. 17.—Heated air drying unit attached to a farm crib. Air is forced through corn from a canvas air duct along one side.

Heated air dryers attached to farm cribs should be attended at all times while running because of the fire hazard involved.

R. L. Erwin

Heredity Influences Vitamins in Corn

Forty-five inbred lines of corn grown at the same location in 1946 showed wide variations in niacin and pantothenic acid content. A group of three lines crossed in various combinations for the study of heterozygosity or plant vigor, and a group of early uniform single-cross hybrids (nine lines crossed in all possible combinations) furnished further evidence that both vitamins are influenced by heredity and that environment may mask some hereditary influence on pantothenic acid. Little correlation between high niacin and high pantothenic acid has been found.

A study of the effect of maturity on vitamin content was initiated. Six double-cross hybrids and one open-pollinated variety grown at Wooster were gathered at several stages of maturity. When calculated to a constant moisture basis both vitamins tended to decrease with increasing

maturity. It is recognized that results obtained in 1947 may not be indicative of the normal behavior of corn, since 1947 was an unusual crop year.

Several double-cross hybrids grown in other Ohio locations were assayed, some of which were gathered supposedly mature but which had become moldy. The moldy samples contained more of both vitamins than did samples of the same hybrid in good condition. Experimental molding of normal corn showed an increase in both vitamins due to synthesis by mold.

C. H. Hunt, Lorraine D. Rodriguez, J. D. Sayre, G. H. Stringfield, and R. M. Bethke

B-complex Vitamins in Cereal Grains

The samples from the 1947 crop of corn, wheat, and oats grown continuously on the same plots since 1893 were analyzed for thiamine, riboflavin, niacin, and pantothenic acid. Some plots received no fertilizer, some complete fertilizer with dried blood, and some yard manure. One end of each plot received lime. Results were compared with analyses of previous crops.

No important effect of either lime or fertilizer was noted on any vitamin, with the exception of a slight decrease in niacin in wheat on the limed end of the plots. This effect was directly opposite to the effect of lime on niacin in wheat noted during previous seasons, although during one season lime treatment was associated with decreased niacin in oats.

Seasonal effect were apparent. The 1947 oats, despite being of very poor quality, contained slightly more thiamine and pantothenic acid and two to three times as much riboflavin as during previous years. Pantothenic acid appeared somewhat higher in wheat also.

Generally speaking, seasonal effects have been responsible for greater variations in the vitamin B-complex content of oats than have soil treatment practices. In wheat, the production of these vitamins seems to be more constant than in oats.

C. H. Hunt, Lorraine D. Rodriguez, and R. M. Bethke

Fruits

Trend to Standard Apple Varieties

Yellow Transparent leads all apple varieties in the frequency with which it is listed in nursery catalogs. A recent survey among 60 nurseries located in 25 states shows that 48 nurseries list this variety; 47 of these 60 nurseries listed Yellow Delicious; 46 Delicious, 45 Jonathan, 39 Wealthy, 30 McIntosh, 28 Red Rome or Gallia Beauty, and 25 Stayman Winesap.

This survey also showed that several of the varieties were listed less frequently than 7 years earlier. In this list of varieties were Northern Spy, Northwestern Greening, Red Astrachan, Rome Beauty, Stayman Winesap, Winesap, and York Imperial. Several of the red strains of standard varieties were listed more frequently than in 1941. Included among such varieties were the red strains of Delicious, Jonathan, Northern Spy, Rome Beauty, and Stayman Winesap.

These facts are not presented to indicate that these should be used as a guide in the choice of varieties in Ohio. In the main, however, the varieties most frequently listed by American nurserymen are the leading varieties in Ohio.

The general trend among these 60 nurseries is towards propagation of fewer varieties and more red strains.

C. W. Ellenwood

Preharvest Sprays Give Variable Results

Jonathan apples sprayed September 30 were harvested October 23. The trees sprayed with App-L-Set (napthalene-acetic acid base) had a total of 35 percent windfalls, while the plot sprayed with 2,4-D (10 p. p. m.) had 29 percent windfalls. The unsprayed bagged branches had 71 percent windfalls.

App-L-Set did not reduce the drop of Stayman Winesap. This was true on plots sprayed on September 30 as well as on those sprayed October 10.

The results with the 2,4-D applied September 30 on Stayman Winesap were quite striking. When the fruit was harvested October 31 the trees sprayed with 2,4-D on September 30 had 6.5 percent windfalls. The unsprayed branches on the same trees had 66 percent windfalls.

The results on the Stayman Winesap sprayed with 2,4-D October 10 showed a reduction in windfalls, but not as great as with the September 30 application. These results are in line with those in other states.

The after-effects of using 2,4-D as a pre-harvest spray have not yet been fully determined. In the spring of 1948 it was observed that the Stayman Winesap trees sprayed with 2,4-D came into bloom a little later than the unsprayed trees. Ohio apple growers are urged to be cautious in the use of 2,4-D and other materials as a preharvest spray until more results are available.

C. W. Ellenwood

Thinning Peaches with a Pole Saves Labor

For several years numerous peach growers have been reducing their labor cost at thinning time by using the bamboo pole method. The equipment consists of a relatively stiff bamboo pole 4 to 5 feet long with a piece of spray hose on one end. The section of hose is 15 to 18 inches long with 8 to 10 inches of free end acting as a hammer.

In using this instrument the branches bearing the fruit are struck sharply to dislodge any partially loosened peaches. A rapid brushing motion along one side of a shoot will usually knock off one fruit from each set of doubles that may be present. The job of thinning to the desired distance can then be completed by striking individual peaches which may need to be removed.

Data collected in the peach orchards at Wooster give an indication of the actual time which may be saved when the pole method is compared with the conventional hand system. Forty-one 5-year old trees which were thinned by hand required 15.4 minutes per man per tree. The same workers thinned 106 similar trees by the bamboo pole method in 6.4 minutes per man per tree. In other words, a man could thin 31 trees per day by hand and 75 trees when the pole method was used.

Vigorous 5-year old peach trees with a moderate to heavy set of fruit were used in this experiment. The pole method becomes more important as trees become older and larger, and in years when an extra heavy crop is set. On young small trees and in years of a light set the advantages are less pronounced.

The technique of thinning peaches with bamboo poles is not difficult to acquire. The operator may at first feel that it is a rather crude method. A little practice however, will demonstrate its value and ease of performance. The worker must be cautioned to avoid excessive thinning when this system is employed.

The bamboo pole method of thinning peaches appears to have real advantages over blossom thinning by the wire or brush broom methods or by blossom thinning sprays. Under Ohio conditions spring frosts may frequently kill many of the flowers before they set fruit. If the crop is thinned during the blooming period and is then further reduced by frost, the grower may suffer severe financial loss. Thinning by the pole method saves labor and money and delays the operation until after the hazards of spring frosts have past.

Wesley P. Judkins

Use of Enzymes in Grape Products

Six different genera and species of molds of known ability to decompose tartrates were grown on different media to ascertain their suitability for producing tartrate-decomposing enzymes.

A mold tentatively identified as an aspergillus was the best mold tested. Grape pomace was found to be the best medium for growth.

The enzymes produced were extracted with water and precipitated from the solution with ethyl alcohol. This crude extract decomposed as high as 57 percent of the tartrates present in grape juice.

Richard Barton

New Fungicides for the Control of Fruit Diseases

Apples.—Flotation and Magnetic sulfur pastes, Micronized sulfur, Fermate, Phygon, and Agricultural Puratized all gave satisfactory control of apple scab. The sticker material known as p. e. p. s. was found efficient. Agricultural Puratized was tested as to its effectiveness of burning out of scab. Following a heavy initial infection of scab, this compound used at 1½ pints per 100 gallons of water reduced scab about 50 percent, whereas lime-sulfur or other sulfurs did not even reduce scab.

A timing experiment, in which Puratized, Fermate, and Phygon were used, gave no results inasmuch as the disease did not appear.

Lime-sulfur, Puratized, and Flotation sulfur paste were tested in concentrates. The fogging or steam type of applicator was used. The applications were made in the early morning when conditions were ideal for such work. The steam or fog drifted into the trees but no control of scab was obtained. It has been found that drifting sprays or dusts are not effective. Apparently, the droplets are too small in size to make effective contact.

Sour Cherries.—The principal aspect of this test was to determine the effect of adjuvants, particularly stickers. Several of the standard fungicides, such as fixed copper, Zerlate, Phygon, and 341 were used

with and without Orthex. When Orthex was used the amount of fungicide was reduced. The object was to reduce injury where possible. The results show definitely that Orthex conserved the fungicide, but no less injury resulted; particularly in the case of the coppers.

Grapes.—Our recommended grape disease schedule has developed weaknesses. Either black rot or mildew or both are not controlled. To study this situation, a materials and timing experiment was set up. The materials used were standard Bordeaux, fixed copper, Fermate, Zerlate, and Phygon. The coppers did not give satisfactory control of black rot. Fermate and Zerlate were very effective, but the latter caused a trace of injury. Fermate early and copper later controlled both black rot and mildew.

H. F. Winter and H. C. Young

Apple Measles or Internal Bark Necrosis

Soil from a badly diseased orchard was brought into the greenhouse and treated in various ways. The treatments consisted of normal and excessive nitrogen of two different forms, added lime, added boron, added boron and lime, and added manganese. Soybeans were also used as an indicator plant for detection of manganese toxicity. An additional treatment consisted of heating the soil for 3 hours in a steam sterilizer.

Data taken on orchard trees show no significant differences so far as the incidence of disease is concerned. The manganese content of diseased bark of orchard trees was found to be considerably higher than that of healthy bark. Whether the accumulation of manganese in diseased bark is the cause of or the result of internal bark necrosis remains to be proven.

Soybeans grown in one soil taken from a diseased orchard in southern Ohio showed manganese toxicity and calcium deficiency. The manganese toxicity to soybeans was greatly increased by heat treatment of the soil and by the addition of manganese sulfate. The addition of lime, on the other hand, corrected the manganese toxicity condition.

Apple trees grown on untreated soil taken from a diseased orchard have thus far shown no visible manganese toxicity nor measles symptoms. Sufficient time probably has not elapsed for this, however. Trees in potted soil which was heated or treated with manganese sulfate show marked reduced growth. Trees treated with excessive ammonium sulfate and calcium nitrate show reduced growth also. Soil from a diseased

orchard showed an excessively high available manganese content. The same soil, heat treated, showed 10 times as much available manganese. Treating the soil with lime greatly reduced the available manganese.

H. F. Winter

Red-banded Leafroller Infests DDT-sprayed Orchards

This native American insect has been present in Ohio for many years. It is a general feeder and has been taken from numerous hosts including forest trees, shrubs, ornamentals, pome and stone fruits.

In nature it is held in check by numerous parasites, and in orchards and vineyards lead arsenate sprays are effective in controlling it. However, during the past 2 years this insect has become a potential pest in orchards and vineyards that have been sprayed with DDT. As an insecticide, DDT is not effective against this leafroller and in addition destroys the beneficial parasites.

Biological work in Ohio has shown that two complete generations and a partial third occur in DDT-sprayed orchards. Larvae of the first generation live on water sprouts and succulent terminal growth, feeding inside of rolled leaves, and also on fruits covered by a leaf. The later generations tend to feed more on the fruits, and under certain conditions

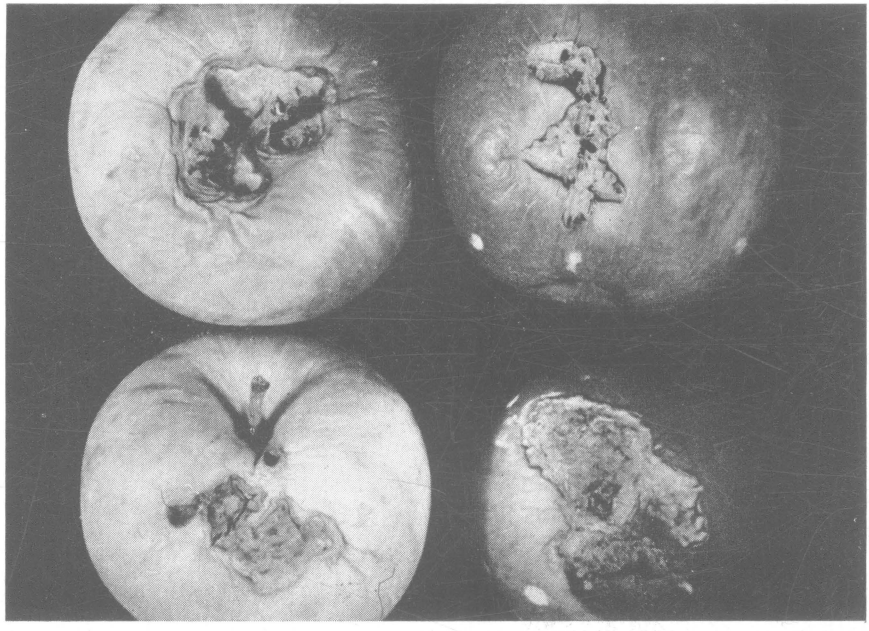

Fig. 18.—Injury to apples by the red-banded leafroller.

many destroy up to 75 percent of the apple crop. Control may be obtained by using lead arsenate alone or in combination with DDT. Tests with several new spray materials are now in progress.

C. R. Cutright

Time DDT Sprays to Control Oriental Fruit Moth in Peaches

Experimental tests carried on in northern Ohio during the past 3 years have shown that DDT has, without exception, substantially reduced injury to peaches by oriental fruit moth larvae. In 1947 four different schedules were tested on Shipper's Red and Fertile Hale peaches in two localities in northern Ohio. These schedules consisted of two, three and four applications of 50 percent DDT wettable powder applied at the rate of 2 pounds in 100 gallons of water.

An examination of the fruit sprayed with these schedules showed that the 8- and 3-weeks schedule gave 95 percent clean fruits while the 8- and 4-weeks schedule gave 97 percent clean fruits as compared with only 58 percent clean fruits in unsprayed check plots. Three- and four-application schedules gave results that were not significantly better than the two-application schedules, and the residues of DDT at harvest were excessive.

Although DDT fulfills the requirements of an effective insecticide for fruit moth control it has been found to be selective in its action on insects and mites present in the orchard and therefore has a tendency to disturb the equilibrium between actual and potential pests and their natural enemies. For example if DDT sprays are applied before July 1, or if more than two applications of DDT are used, populations of orchard mites may reach damaging proportions by harvest and seriously affect the flavor and quality of the fruit.

For most large orchards where spraying is done from a tower, the most practical schedule consists of two applications of DDT made 8 and 3 weeks before Elberta harvest. In smaller orchards, where it is possible to spray the trees from the ground and where varieties are mixed, the 8-weeks spray may be applied to all varieties and a second spray applied to South Haven, Hale Haven, and Elberta about 4 weeks before harvest. This schedule would eliminate the necessity of applying separate sprays for these varieties.

Roy W. Rings

DDT Controls Peach Tree Borer

The effectiveness of DDT sprays in control of the peach tree borer was demonstrated in an Ottawa County peach orchard in 1947.

All except 50 of a block of around 2,000 peach trees were treated in a cooperative experiment. Only the trunks were sprayed, but special attention was given to the base of each tree. DDT was used at the rate of 4 pounds of a 50 percent wettable powder in 100 gallons of water. It was applied three times at 20-day intervals, beginning July 10.

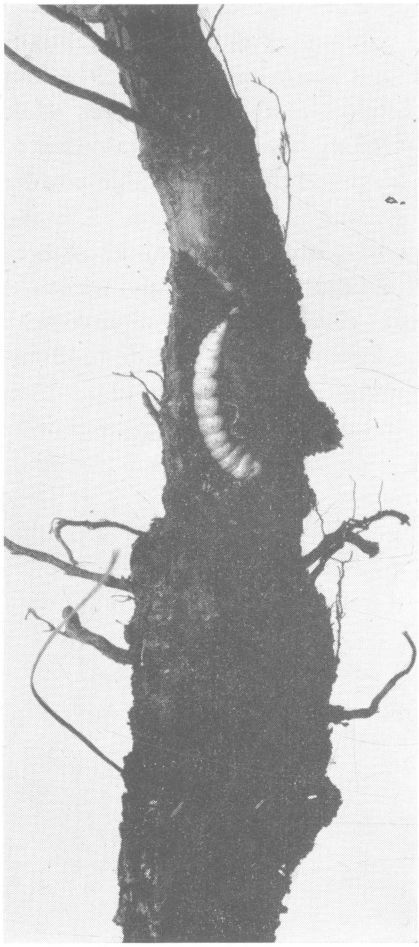

Fig. 19.—A peach tree borer on the root of a young tree.

Twenty-five trees, taken at random in the treated area, were examined for borers on October 22. The ground was removed from the base of each tree to a depth of 4 inches. Loose bark and soil were removed from the trunk with a jack knife, but no borers were found. In the untreated block of 50, a total of 23 borers were found on 25 trees examined in the same manner. Feeding scars were observed on nearly all trees and as many as three larvae were found on one tree.

Replicated experiments with benzene hexachloride in an orchard in Wayne County showed that this material is also toxic to peach tree borer larvae. It was used as a soil fumigant in much the same manner as that in which paradichlorobenzene is used. The results indicate that effective control measures could be devised with benzene hexachloride. However, such control measures would require more labor and expense than the DDT spraying schedule described above.

R. B. Neiswander

Vegetables

Vitamins Increase Mushroom Yields

Further trials with the B-vitamins, thiamin, riboflavin, niacin, pantothenic acid, pyridoxine, and biotin show that they will increase the yield of the common mushroom under certain conditions. These trials have been carried on for 2 years in two different mushroom-growing establishments with similar results.

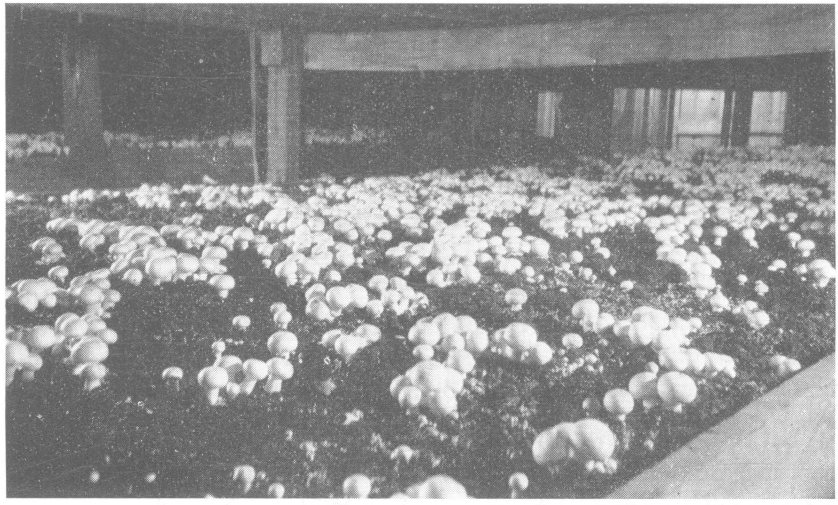

Fig. 20.—Mushroom beds in commercial production. Other beds are in tiers above and below these.

The past year the average percentages of increases in yield of the vitamin-treated plots over the average of the untreated check plots were as follows: Niacin 29.4 percent, pantothenic acid 16.6 percent, thiamine 13.5 percent, riboflavin 9.8 percent, and pyridoxine 4.9 percent. Biotin was not included in the test last year, but in a previous experiment it increased the yield 13.8 percent.

I. C. Hoffman

New Hormone for Greenhouse Tomatoes Shows Promise

Treatment of greenhouse tomato flowers with synthetic hormones continued to result in an outstanding improvement in yield. The average weight per plant for the first two clusters was more than doubled

when treatment was superimposed over flowers which were presumably pollinated by vibration. This increase in yield was due in part to increase in weight of the fruit. This, too, has been the usual result over the 10-year period during which work with synthetic hormones has been carried on at the Experiment Station.

Unfortunately, during the last 3 years, flower treatment has been associated with a premature softening of some fruits which has almost completely restricted the use of such chemicals in improving greenhouse tomato yields. Fruits resulting from emasculated flowers (stamens removed to prevent pollination) softened much faster than those vibrated flowers receiving identical treatment.

Furthermore, one treatment or chemical (ortho-chlorophenoxyacetic acid) produced fruits firmer than those from untreated flowers. This greater firmness has been noted before with chemicals which do not produce fruits of satisfactory size, but not with any chemical which improved both size and yield. It is hoped that these results may eventually lead to re-instatement of the use of chemicals in greenhouse tomato production.

F. S. Howlett

Hormone Treatment of Field Tomatoes

In the field, flower treatment has not at any time during the last 5 years increased the yield of plants grown for canning. However, when tomato plants were grown in a cheesecloth shade chamber the yield of treated flowers was greater than that from untreated flowers but even this improvement in yield did not exceed that of plants grown outside and exposed to full sunlight.

However, the number and size of fruits on the first and second clusters was frequently improved. This increased set was not reflected in the final yield. This indicates that it may be profitable for the home gardener to treat the flowers on the first developing clusters of his tomato plants. Premature softening, a matter which has plagued the greenhouse tomato grower, would be of little consequence to him.

F. S. Howlett

Vegetable Crops Differ in Fertilizer Needs

At the Washington County Truck Crops Experiment Farm, a fertilizer experiment with four early vegetable crops has been conducted

since 1915. The four crops are grown in regular rotation on land cropped every year. Consequently, the differences in their fertilizer requirements have been clearly demonstrated.

The recommendations drawn from the 33 years of the experiment are listed in the following tabulation:

Fertilizers for four vegetable crops grown on sandy loam soil to be applied before planting

Crop	Pounds per acre	Formula	Side dressings of nitrogen-carrying fertilizer
			No.
Cabbage	1,000	8-4-12	One
Cucumbers	1,000	8-4- 8	None
Tomatoes	500	10-8-10	None
Sweet corn	320	Nitrate of soda	One

To some degree the amount of fertilizer needed depends upon the tonnage of the crop. Thus cabbage yielding 10 to 15 tons of marketable heads per acre requires nearly twice as much fertilizer as tomatoes which regularly yield 6 to 8 tons of fruit. Sweet corn, which has yielded only 3 or 4 tons of ears per acre, has required nothing but a liberal application of nitrogen fertilizer.

John Bushnell

Develop New Glasshouse Tomato Variety

The testing of the wilt-resistant tomato hybrids for glasshouse use has resulted in the introduction of a new variety named Ohio W-R Globe (fig. 21). At the present time it is being grown on a wide scale in glasshouses of northern Ohio where its adaptability has been proven. As more seed becomes available the acreage will be increased.

The work to produce wilt-resistant canning types has progressed slowly because the accessions have not purelined as satisfactorily as the glasshouse types. To overcome this difficulty, it will be necessary to root cuttings and self the plants in the greenhouse.

L. J. Alexander

Zerlate Gives Best Control of Tomato Anthracnose

The fungus was readily recovered from both tomato fruit tissue and a cellulose substrate overwintered out-of-doors in the soil. The pathogen can infect green tomatoes but symptoms appear only as fruit ripens.

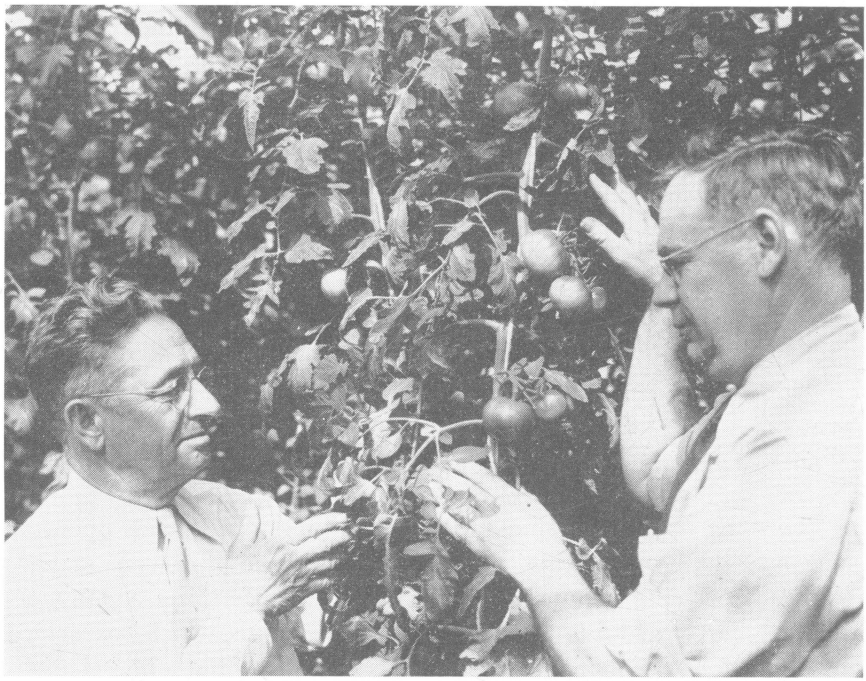

Fig. 21.—Making an inspection of the new Ohio W-R Globe tomato variety.

Approximately 18 percent of fruits on staked Gulf State Market, inoculated by soil contact when green, had anthracnose when ripe. Similar results were obtained with a spore suspension applied to Fordhook Hybrid.

Best control of anthracnose was obtained with Zerlate; Bioquin was a fair second. Control was mediocre with Dithane and Parzate and poor by fixed coppers and Bordeaux.

Neither a straw mulch nor seven fungicides applied to the soil when the plants were falling over reduced the amount of anthracnose. Materials such as nickel bordeaux and cyanamid that caused foliage and fruit injury doubled incidence of the disease. There was no worthwhile resistance in varieties; Long Red and two or three unnamed hybrids exhibited some tolerance to anthracnose.

H. A. Runnels and J. D. Wilson

Oils and Other Adjuvants as Dust Adhesives

Various types of light oils were added to fungicidal dusts for late blight of potatoes at 2, 3, and 5 percent by weight in an effort to improve adhesion of the active ingredient (a fixed copper). Neither adhesion nor disease control were appreciably increased by the use of oil. The use of small amounts (10 to 15 percent) of other diluent materials such as diatomaceous earth or Fuller's earth to replace an equivalent amount of talc did improve adhesion to some extent.

J. D. Wilson

New Fungicides for Vegetable Disease Control

Some of the new organic fungicides gave a degree of disease control on potatoes and tomatoes, as well as some other vegetables, comparable to that furnished by such older inorganics as Bordeaux mixture and the fixed coppers. Zerlate has been outstandingly effective against anthracnose fruit rot of tomato. Zerlate, Parzate, and Dithane were effective against early blight on tomato and potato. Dithane and Parzate gave comparatively good control of late blight on these crops, but Zerlate was less effective.

Another organic material under the experimental name of Zac also did very well on potatoes and tomatoes. A new inorganic known as copper-zinc-chromate also gave good control of early and late blight on potatoes and tomatoes, but was slightly injurious on the latter.

J. D. Wilson and H. C. Young

Fumigate Greenhouses to Control Mites

The use of fumigants for the control of the two-spotted spider mite in greenhouses has been investigated during 1947 and 1948. This method of control is proving more economical as well as more efficient than sprays and dusts.

In 14 tests with a commercial brand of wettable powder containing 70 percent azobenzene, an average mortality of 94.3 percent was obtained. The wettable powder is mixed with water to produce a paint-like substance that is painted on cold steam pipes. It is then volatilized by introducing steam into the pipes.

To determine the maximum efficiency, mite mortality records were taken 5 days after fumigation. Eggs as well as active mites were killed. cucumber foliage and still obtain effective results, temperatures must be However, it was found that in order to avoid injury to tomato and held at approximately 75 degrees F. for a period of at least 6 hours.

Azobenzene in pressure fumigators has recently become available for fumigating purposes. Such fumigators save the labor of painting steam pipes and can be used where steam is not available. In five tests with these fumigators, mortality records taken 5 days after fumigation showed an average mortality of 94 percent of the two-spotted spider mites.

R. B. Neiswander

Aerosols Give Fair Mite Control

Aerosols in which an acaricide is propelled into the air by a liquified gas are also being investigated. In three tests with an aerosol containing 10 percent hexaethyl tetraphosphate, the average mortality among active mites determined 24 hours after fumigation was 94 percent. However, succulent tomato foliage was injured by the treatment and mite eggs were not destroyed.

With an aerosol containing 2½ percent tetraethyl pyrophosphate, an average mortality among active mites of 85.5 percent was obtained in four tests. This aerosol appears safe on both cucumber and tomato foliage, but because the eggs are not killed it must be used 3 or 4 times at 3-day intervals to control a population that has reached damaging proportions.

This method of mite control is very practicable because a greenhouse with a capacity of 1 acre can be fumigated with a 5-pound bomb in approximately 15 minutes. However, tetraethyl pyrophosphate is very poisonous and a gas mask must be worn by the operator while releasing the fumigant.

R. B. Neiswander

New Insecticides for Cucurbits

Three percent methoxychlor dust and 3 percent aerosol grade DDT each gave satisfactory control of cucumber beetles in experiments conducted in 1946 and 1947. Neither of these materials was injurious to cucurbit plants whereas commercial grade DDT and benzene hexachloride injured the seedlings when used at the same concentration.

The insecticide should be combined with either a fixed copper or Zerlate to provide protection against leaf and fruit diseases. The dust may be purchased ready mixed or it may be prepared by mixing together 6 pounds of insecticide, 10 pounds of fungicide, and 84 pounds of talc.

The first application of the dust mixture should be made when the young plants are breaking through the surface of the soil and subsequent applications at sufficiently close intervals to keep the new growth covered. When showers wash off the protective dust it must be replaced.

J. P. Sleesman and J. D. Wilson

Newer Potato Varieties Yield Well Without Sprays

New insect- and disease-resistant potato varieties are being developed by the U. S. Department of Agriculture in cooperation with state agricultural experiment stations. A large number of important characters such as resistance to leaf roll, scab, ring rot, late blight, leafhoppers, flea beetles, Colorado potato beetle, and aphids are being considered in producing superior varieties. New combinations between selected seedlings should give more valuable commercial sorts because they combine several favorable characters in one variety.

In 1947 sixty-eight named and numbered varieties were grown in a planting at Wooster which was not sprayed with either an insecticide or a fungicide during the entire growing season. The potato leafhopper and late blight were about equally important in limiting yields on these plots. Twelve disease- and insect-susceptible varieties, including the most popular commercial varieties now in use, gave an average yield of 74 bushels per acre as compared with 320 bushels per acre for 12 insect- and disease-resistant numbered seedlings.

Fig. 22.—Potato vines on left are free from injury; those on right completely killed by insects and diseases.

The foliage of the susceptible varieties was severely injured whereas that of resistant varieties remained vigorous and healthy (see fig. 22). Recently one of the latter has been named Kennebec by the Maine Agricultural Experiment Station in cooperation with the U. S. Department of Agriculture.

J. P. Sleesman

Corn Borer Control in Sweet Corn

In a study of the number of insecticide applications required for commercial corn borer control in sweet corn 0-, 2-, 3-, and 4-application schedules were made. Each treatment was replicated 4 times. In the 4-application schedule, the insecticide applications were made at 5-day intervals beginning June 30; in the 3-application schedule, they were made on July 4 and 11, with an interval of 7 days between treatments. In each instance the schedule was set up to produce the optimum effectiveness for the number of applications made.

The insecticides used were DDT spray and Ryanex dust, both of which have given very effective results in recent years in the full 4-application schedule. The DDT spray was used at the rate of one pound of technical DDT to 100 gallons of water and approximately 125 gallons was applied per acre. A 40 percent Ryanex dust was applied at 40 pounds per acre.

At sweet corn harvest time, 5 plants were dissected from each replicate of all treatment schedules. The results from the two materials used were similar, although the DDT spray was somewhat more effective in the 2- and 3-application schedules than was the Ryanex dust. The mean borer population in the untreated blocks was 19.4 borers per stalk.

The results indicate that for market garden sweet corn, where a single borer in an ear is objectionable, 4 applications are essential; but for canning sweet corn and for dent corn, 2 or 3 applications may give a sufficient reduction in the borer population to be economically practicable when 4 would be impracticable because of the increased cost. However, the number of applications required in any field will depend upon the intensity of the corn borer infestation.

C. R. Neiswander

Ornamental Plants

Greenhouse Rose Roots Affect Top Growth

Experiments on roses have stressed the importance of the root system in obtaining maximum growth of the tops. Factors in the root environment which became limiting apparently affected the growth of the tops of the plant before affecting the root system. The roots grew while the tops remained in a stunted condition which resulted in a top-root ratio approaching unity.

A high moisture content of the soil increased the top growth of the rose plant until the soil became saturated or the moisture otherwise limited the aeration of the soil and of the rose roots.

A root temperature of 52° F. resulted in very limited top growth compared to 62° F. or higher. The top-root ratio increased steadily with increasing root temperature from 52° F. to 72° F.

Roots of roses apparently can utilize oxygen and function satisfactorily when the concentration of oxygen is only 2 percent. Reduction of oxygen to the zero point resulted in the immediate defoliation of the plants followed by their death.

Alex Laurie and D. C. Kiplinger

Watering Method for Carnations

Either the constant water level or Ohio State overhead irrigation method of watering is satisfactory on carnations. The production per plant and quality of flowers secured are equal to plants watered overhead in the usual manner, but the labor required for watering is materially reduced.

The highest production and quality may be secured from plants grown in gravel culture.

Alex Laurie and D. C. Kiplinger

Grow Orchids in Gravel Culture

Growing orchids in gravel culture is a practical procedure in reducing the labor necessary in the culture of this plant. Further savings may be made by subirrigating orchids in gravel with a nutrient solution.

For this purpose a water-tight bench is necessary and after a 3-year trial, aluminum was found to be a satisfactory material for bench construction. Greater production is secured if the plants are potted and the

pots plunged in haydite in the water-tight bench. The WP solution at half strength is the recommended nutrient solution.

Alex Laurie and Raymond Hasek

Ohio State Surface Irrigation

Labor constitutes about 45 percent of production costs and the labor of watering cut flower crops is 30 to 40 percent of the total cost of labor. A simple yet practical means of overhead watering cut flower crops has been devised which reduces the labor required.

A one-inch pipe line laid on the soil surface is connected to the main water line. With single slot nozzles, holes should be drilled every 12 inches in the pipe, but with full circle nozzles, holes every 2 or 3 feet are practical. When in operation, the nozzles throw a flat fan of water parallel to the soil and a uniform coverage of the greenhouse bench is obtained within 5 to 10 minutes. With the ordinary water pressure and volume in a greenhouse, 50-foot lengths of pipe may be connected to one water inlet. The wetting of lower foliage is no greater than with the ordinary method of applying water to the soil by means of a hose.

Alex Laurie and Raymond Hasek

Gardenia Flower Buds

Results of experiments conducted during the past year to determine the effects of some external factors on the abscission of gardenia flower buds indicate that the water content of the growing medium does not influence the percent of buds that abscise, provided the water supply is replenished when the water in the medium reaches a tension of 5 to 7 inches of mercury or less. However, when gardenia plants were grown by the constant water level method the percentage of bud abscission was half again that of overhead watered check plants.

In a series of gardenia plots grown by the gravel culture method and shaded with various thicknesses of aster cloth to reduce the light intensity during the winter there was a relatively high percentage of abscission, regardless of the light intensity at which the plants were grown. The total number of buds produced per plant and the average size of bloom was reduced in proportion to the reduction of the normal light intensity to which the plants were subjected.

Alex Laurie and Raymond Hasek

Mulches for Outdoor Roses

Controls and the following covers were used in duplicate plots: (1) clean cultivation or check, (2) sphagnum peat moss, (3) ground, new corncobs, (4) sweet alyssum, (5) *Portulaca,* (6) alsike clover, and (7) Chewing's fescue.

Data show that ground, new corncobs have given the best flower production and growth, with *Portulaca* and clean cultivation giving nearly as good results. The peat moss plots gave average results, with the Chewing's fescue and alsike clover covers giving relatively poor results.

Tests of non-capillary porosity showed the lowest percentage under the corncob mulch, with the percentage in the Chewing's fescue and alsike clover plots being the highest. The other plots were intermediate in percentage of non-capillary porosity. Aggregation analysis showed the highest percentage in the corncob plot. The alsike clover plots showed lowest percentage of aggregation. The other plots were nearly the same and intermediate. The corncob plots also showed the greatest proportion of aggregates of the larger sizes.

L. C. Chadwick

Propagation of Ornamental Plants

Propagation by cuttings has included experiments dealing with relative humidity, methods of watering, use of different mediums and the use of a fluorescent light-equipped opaque basement structure for propagation.

Softwood, deciduous cuttings showed the best rooting under a relative humidity of 70 percent. Most evergreen cuttings responded favorably under 60 percent relative humidity. A continuous relative humidity of 70 percent was more favorable than one maintained at 70 percent only between the hours of 8 a. m. and 3 p. m.

In general, best results have been obtained where overhead watering was employed. Forced subirrigation has given some favorable results. Constant level has given comparatively poor results. Vermiculite No. 1 and silica sand No. 7 have in most cases produced more roots of a more desirable quality than silica sand No. 5, bank sand or Vermiculite No. 2.

Evergreen cuttings handled in an opaque basement greenhouse equipped with fluorescent lights did not respond satisfactorily in these experiments. Gold light gave the best results followed by white, daylight, and red lights.

The experiments with evergreen grafts have been concerned with suitable understocks for Junipers and studies of handling Juniper grafts in open cases.

Juniperus virginiana appears to be the most satisfactory understock in the experiment to date. *Thuja orientalis* and *Juniperus horizontalis plumose* have given poor results. *Juniperus chinensis, J. communis* and *J. excelsa stricta* have given intermediate results.

Grafts handled in open cases were as successful as those handled in the conventional closed case, when a relative humidity of 85 percent was maintained in the grafting house.

L. C. Chadwick

Snapdragon Rust

Five fungicides were tested in 1947 as part of a cooperative field experiment on control of snapdragon rust *(Puccinia antirrhini)*. The percentage of plants with rust in early October, after eight spray applications, was as follows: Bordeaux mixture 8-8-100, 16.4; wettable sulfur 3-100, 83.1; resin-lime-sulfur 2 percent 62.3; Fermate 2-100, 3.4; Parzate 2-100, 0.0; no treatment, 89.2. Bordeaux and resin-lime-sulfur caused foliage injury.

H. A. Runnels

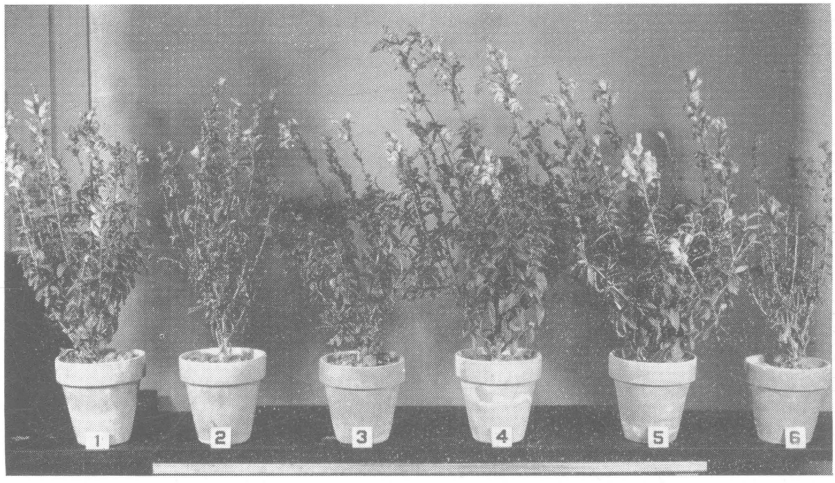

Fig. 23.—Typical snapdragon plants from (1) Bordeaux mixture, (2) wettable sulfur, (3) resin-lime-sulfur, (4) Fermate, (5) Parzate, and (6) no treatment plots.

Weed Control

Chemical Weed Control for Vegetables

The control of weeds in vegetable crops by means of various chemicals during the 1946 and 1947 growing seasons has shown considerable promise. These studies have also revealed that damage to the vegetable crop through the use of these materials is possible. Where regular cultivation practices will control weeds, there is no reason to use chemical weed control measures. Where the cost of mechanical or hand weeding methods are prohibitive, chemical weed control measures might be considered.

All chemical treatments should be considered as a delaying action in relation to weed growth and regular cultivation should be initiated before weed growth increases.

All 2,4-D recommendations are based on acid equivalent. The exact amount of any given formulation will vary with active ingredients in the commercial product. Poor weed control or severe damage to crop may result if slight errors are made in preparing spray.

Asparagus.—Two pounds of ester or two pounds of sodium salt of 2,4-D applied several days before start of harvesting season. This treatment should be repeated toward the end of the cutting season if weeds become a major problem. Any spears which are exposed to direct application of 2,4-D will be damaged and are not marketable.

Sweet corn.—One pound of ester or two pounds of sodium salt of 2,4-D applied 1 or 2 days before the corn emerges, or 0.25 pound of ester or 0.5 pound of sodium salt applied when the corn is 2 inches high. If weeds are larger than 4 or 5 inches at this time, it might be well to double the concentration of the spray. Later applications of these rates may be made when corn is taller; however, visible injury to corn is likely.

Carrots, dill, parsnip.—Eighty to one hundred gallons of Stoddard Solvent (or comparable 15 percent aromatic content oil) applied when seedlings are 3 to 4 inches high. Do not repeat treatments.

Onion.—(1) Ester of 2,4-D (0.25 pound) applied 1 or 2 days before onions emerge has proven very worth while on loam soil; or (2) 8 pounds of sodium penta-chlorophenate per 100 gallons, applied when onions are about 3 to 4 inches high (temperature range 60 to 75° F.

appears to be best for application period) or (3) Stoddard Solvent or equivalent applied at the rate of 80 to 100 gallons per acre, one day before onion emergence.

Potatoes.—(1) One pound of ester or two pounds of sodium salt of 2,4-D applied 1 or 2 days before potato sprouts emerge; or (2) 0.25 pound of ester or 0.5 pound of sodium salt applied when potatoes are 6 to 8 inches high; or (3) 50 gallons Stoddard Solvent or equivalent fortified with 2 pounds of penta-chlorophenol, applied the day before potato sprouts emerge.

E. K. Alban

Pre-emergence Weed Control in Sugar Beets

Because of the considerable success of California experiments with the chemical control of weeds in sugar beets, a project involving the cooperation of the Department of Agronomy and the Department of Botany and Plant Pathology of the Ohio Agricultural Experiment Station, The Farmers and Manufacturers Beet Sugar Association, and several manufacturers of chemical weed control materials was started on the farm of Ralph Watson at Fremont in April, 1948 (fig. 24). Clyde Wilson of the Department of Agronomy was in charge of the work.

The main test consisted of the following formulations applied per acre: aromatic oil at 12½, 25, and 50 gallons per acre; aromatic oil fortified with 10 percent pentachlorophenol and an emulsifier at 2½, 5, and 10 gallons; aromatic oil fortified with 5 percent 2,4-dinitro secondary butyl phenol and an emulsifier at 2½, 5, and 10 gallons. All formulations were diluted to 50 gallons and replicated three times. They were

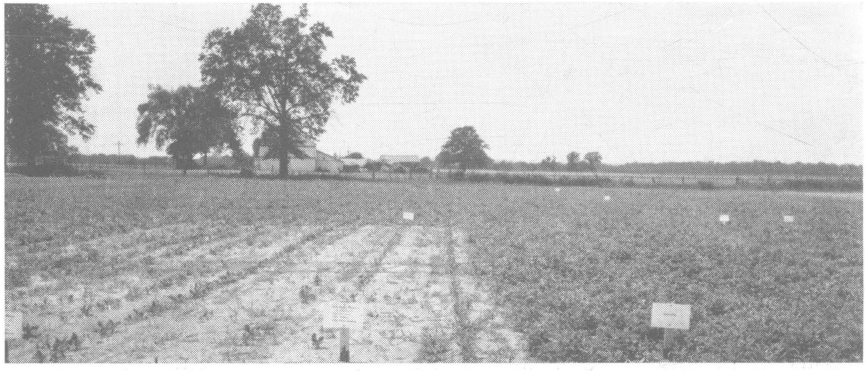

Fig. 24.—Experimental weed control plots of sugar beets on the Ralph Watson farm near Fremont, Ohio.

applied immediately following the seeding of the beets at 3 planting periods, namely, early, medium, and late. The season was below average in temperature and rainfall and weed population not too heavy until June.

Satisfactory control of weeds was obtained with the second and third concentrations of each formulation. However, injury to the beets was obtained with all of the oil and dinitro treatments that were strong enough to control weeds. Pentachlorophenol in aromatic oil controlled weeds at the 5-gallon dosage, but gave a slight reduction in stands at the 10-gallon dosage.

A timing and dilution series was set up with these same formulations. Treatments were made 2 and 4 days before beet emergence with 1¼, 2½, and 5 gallons of aromatic oil fortified with 1¼, 2½, and 5 percent pentachlorophenol and dinitros, respectively. The results indicated again that with pentachlorophenol a margin of safety and effective control of weeds existed. The control extended over a rather long period. It was possible to mechanically block and thin the beets in the pentachlorophenol plots without hand labor. Although the pentachlorophenol treatments were very promising, no general recommendations can be made at present without further studies.

H. C. Young, C. J. Willard, and Clyde Wilson

Flame Cultivation Not Practical in Ohio

Along with other cultural practices, a flame cultivator was used during the summer of 1947 on soybeans in rows. Although the flame cultivator is effective in controlling small weeds in the row, this does not seem to be a practical method of controlling weeds in Ohio because of the high cost of fuel.

If flame cultivation is to be used, the soil must be flat-cultivated in order to keep irregularities in the ground surface from deflecting the flames up into the leaves of the plants being cultivated. The size of the crop and the speed of travel are also important factors. The weeds are killed by exposure to an intense heat which ruptures cell walls causing desiccation and eventually fermentation and decay.

H. M. Gitlin and R. L. Erwin

Sodium Chlorate Kills Yucca

Throughout much of the year the above-ground part of Yucca or Adam's-needle consists of a clump of long, linear stiff evergreen leaves with marginal fibers. In the spring it sends up a woody stem on the terminal end of which is borne in July a panicle of nodding showy white flowers as shown in figure 25.

Yucca may be killed by applying sodium chlorate. Four plants were sprayed in December of 1947 at different rates : 1, 2, 3, and 4 pounds per 100 square feet, covering an area of 5 by 5 feet around the plant. In the summer of 1948 no sign of life appeared in any of the four plants except the one receiving chlorate at the rate of 3 pounds per 100 square feet. Only two small clumps of leaves developed on it. In this case, presumably the root extended beyond the area covered by the spray, as the root is not always directly under the above-ground part. Another yucca plant of large size sprayed with sodium chlorate at the rate of ½ pound per 100 square feet was severely injured but not completely killed.

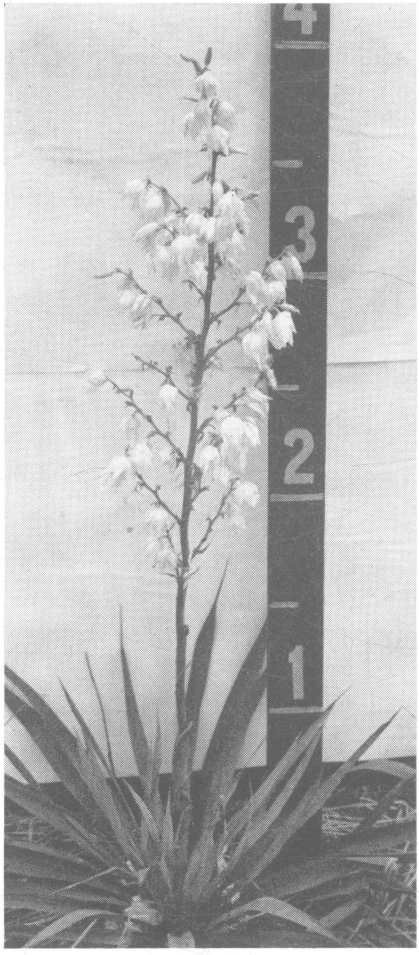

Fig. 25.—Yucca plant in bloom.

It is concluded that yucca can be killed with sodium chlorate using at least 1 pound per gallon of water and on 100 square feet; or 4 ounces on a circular area at least 5 feet in diameter surrounding the individual plant. On soils other than the Wooster silt loam some modification in quantity of chlorate may be required.

F. A. Welton

Experiments With 2,4-D on Small Grains

Post-emergence treatments of 2,4-D have been made at Columbus on wheat, oats, and barley, at rates of 2,4-D varying from 1/48 pound to 4 pounds acid equivalent per acre. All of these crops have been treated at various stages of growth from the time they emerge until they reach maturity.

Winter wheat and winter barley are most tolerant to 2,4-D in the spring when 4 to 8 inches tall. Care should be taken if small grains are treated after they begin to joint, because they appear to be most susceptible to 2,4-D injury at this stage of growth. Experimental data has shown that winter grains are not injured by 2,4-D at rates of ½ pound per acre or less if they are treated before jointing or after the seeds have reached the hard dough stage.

Spring oats are most tolerant to 2,4-D when 4 to 8 inches tall, before jointing begins, and again after they are in the milk stage. Oats may be treated with ¼ to ½ pound of 2,4-D acid equivalent per acre at the above stages of growth without injury or reduced yields.

If alfalfa, red clover, the sweetclovers, or alsike are seeded with the small grains, 2,4-D should not be used on the fields unless the weed problem is considered more serious than the partial loss of the meadow seeding. Since the legumes above are susceptible to 2,4-D, the amount of damage will depend on the amount of spray particles reaching the legumes. This is affected by the stage of growth of the small grain at the time of treatment, the amount of the chemical applied, and the volume of spray solution used.

There is no doubt that 2,4-D will kill alfalfa, red clover, alsike, lespedeza, and the sweetclovers. Ladino and common white clover are intermediate in susceptibility to 2,4-D. Where hay or pasture fields contain a serious infestation of weeds and only a small amount of clover it would seem desirable to treat the fields at the rate of one pound of 2,4-D acid equivalent per acre for the control of such weeds as dandelion, buckhorn plantain, curled dock, Canada thistle, and field bindweed. If the treatment is made in the late summer, clover can be reseeded the following spring with reasonable assurance of successful reestablishment.

C. J. Willard and Warren C. Shaw

Chemical Weed Control in Corn and Soybeans

Experiments in post-emergence treatment of corn with 2,4-D suggest that from ¼ to ½ pound of 2,4-D acid equivalent per acre be used after the corn and weeds are up. Application can be made any time a

severe weed problem exists. The most favorable time to spray for the control of most weeds appears to be from the time corn is about 4 to 12 inches tall. The spraying of single-cross seed fields is not recommended until more information is available.

Pre-emergence and post-emergence applications of 2,4-D on soybeans have given inconsistent experimental results. Some of the experiments have been encouraging, but the work is entirely experimental and no 2,4-D should be used on soybeans with the present information.

C. J. Willard and Warren C. Shaw

Phloem Necrosis Disease of Elm

Since the causal organism has been determined as a virus, the control phase is being studied from two angles; the selection and propagation of resistant species of elm, and spraying for the control of insects involved in the spread of the disease. The use of spray concentrates have been tested and have yielded promising results.

New species of elms have been found resistant to phloem necrosis. These are being propagated and it is hoped that resistant elms will be ready for distribution in the near future. The spray work has been conducted by Dr. R. R. Whitten, entomologist of the Federal phloem necrosis laboratory at Columbus.

H. C. Young

Japanese Beetle

Japanese Beetle

The effect of weather on the insect.—The dry period during July and August, 1946 retarded the development of the newly-hatched grubs to the extent that 60 percent of them entered the winter less than half-grown. The cold wet spring of 1947 caused a further retardation in the growth of the grubs. The result was that the beetles emerged over a long period of time during the 1947 season, the maximum flight period occurring about a month later than the more nearly normal years of 1942, 1943, and 1944. The prolonged flight period necessitated an additional spray application for effective beetle control.

Control of the beetles.—Toxaphene, a chlorinated camphene, applied to grape foliage every 10 days during the beetle flight period gave effective control when used at the rate of one-half pound of the technical material to 100 gallons of water. The results were comparable to those obtained after using one pound of technical DDT in the same amount of water.

Control of the grubs.—Chlordane applied to the soil at the rate of 5 pounds of the technical material per acre, and benzene hexachloride applied at the rate of 2½ pounds of the gamma isomer per acre were as effective in controlling the grubs as is lead arsenate when applied at the rate of 500 pounds, or DDT at the rate of 25 pounds per acre.

J. B. Polivka

Food and Clothing

School Lunch Program

This project is being carried on cooperatively with Iowa and Kansas and the Bureau of Human Nutrition and Home Economics. Information has been obtained by questionnaire as to the number and kinds of school lunches served in the Ohio schools. Techniques for determining nutritional status and those required to obtain certain information related to the value of the school lunch have been developed and tested in a pilot study.

Physical measurements, medical and dental examinations, lists of food preferences, records of food intake, and mental maturity and personality tests were made on a group of 57 children in a county elementary school located near Columbus. The families of these children were visited; they reported on food and health habits, economic status, and food consumption. Approximately two-thirds of this group of children ate the school lunch; the other one-third either brought their lunch or went home for lunch. It is hoped to discover relationships between the adequacy of the diets, the nutritional status of the children, and food expenditures.

Mary Brown Patton

Calcium and Phosphorus Ratios

The calcium and phosphorus retentions as influenced by level of intake and ratio of one mineral to the other in the diet were observed in 18 college women, nine located at the University of Minnesota and nine at The Ohio State University. The balance periods were one week in duration, preceded by a period of one week on the same diet. The subjects were maintained on a basal diet providing approximately 0.3 gram calcium and 0.8 gram of phosphorus.

Supplements of these minerals to the basal diet were made at two levels, 0.6 and 1.2 grams daily for calcium and 0.3 and 0.6 grams for phosphorus. The relation between calcium intake and storage was significant. The storage by the Minnesota girls was less than for those in Ohio. The amount of phosphorus in the diet did not cause a significant difference in the storage of that element at the basal level of calcium intake; however, at the two higher levels of calcium intake an increase in the amount of phosphorus resulted in a significantly greater storage of that element.

To evaluate the validity of the metabolic response of the experimental subject on a certain diet, further studies are being made. The extent of variation within and between individuals on a constant diet, and the length of observation necessary for the individual to adjust to a prescribed diet is under consideration.

Eva Donelson Wilson and Mary Brown Patton

Carotene and Vitamin C in Vegetables

In general, it was found that any level of nitrogen, calcium, magnesium, manganese, boron, or iron which reduced the intensity of the green color of leafy vegetables also reduced their carotene content.

Significantly higher ascorbic acid values were obtained in chard from plots where nitrogen, magnesium, manganese or potassium levels were low. Similar results were also obtained from kale and New Zealand spinach.

H. D. Brown, M. R. Shetlar, Mary Brown Patton, and Leonard Conover

Crushed Ice Preserves Vegetables

The results show that use of crushed ice refrigeration preserves the garden-fresh appearance, weight, nutritive value of Ohio-grown vegetables during transporation and handling. Locally-grown produce will

compare more favorably with that shipped from other states which has been protected in transit by refrigeration and may demand comparable price.

Mary Brown Patton

New Type Washing Machines

Investigations of washing machine studies previously done and in progress by colleges and industry have been made. Techniques for testing and analysis of machines have been developed. A new research laboratory has been developed and equipped and was occupied in February, 1948. Special testing of the machines is in progress.

Ten farm, industrial, and college families have provided regular weekly washings and washable home furnishings for experimental purposes. Standard soil, whiteness retention, strength, wear and shrinkage tests are being made with each washing machine. These tests are being repeated 50 times to represent 2 years' washing of garments and fabrics. Fading and wear tests are also being made with the different types of clothes dryers.

Elaine Knowles Weaver

Forestry

Maple Syrup Research

The study of the factors influencing maple syrup production in Ohio has been in progress for the third successive year. Although the past 3 years have been considered poor syrup years, considerable progress has been made in working out cost account records, and other factors influencing the making of maple syrup.

Ohio produces maple syrup annually valued at approximately 1½ million dollars, and has ranked third in production in the country since 1850. The average cost of production in 1946 was $3.49 per gallon, in 1947 $2.65, and in 1948 $3.17. Many factors enter into the cost of production such as sweetness of the sap, spacing of trees, types of labor and equipment used, amount of sap produced by individual trees, hauling distances, fuel, and others.

The cost per gallon of syrup tends to vary inversely with the volume and sugar content of the sap for each bucket hung. Much of this is due to the site, tree, and stand characteristics; although in some cases it may be due to time of tapping and retapping.

Fig. 26.—Mechanized gathering of the sap can influence the cost of production.

Based on 23 sample plots distributed in northeastern Ohio, the average per bucket hung was 9.33 gallons of sap, which tested 1.6 percent sugar, and produced .2 gallon of syrup. The average volume of syrup produced ranged from .08 to .32 gallon per bucket. Sugar tests on sap from test plots and storage tanks ranged from 0.8 to 2.3 percent. This figure is .2 percent lower than the previous year and this fact was also brought out in production records.

W. R. Anderson

Many Kinds of Wood Waste

In cooperation with two wood-using concerns, an investigation of the supply of sawdust, shavings, slabs, and edgings was undertaken. These materials, natural by-products of the conversion of trees into wooden products, represent a virtually un-tapped source of raw material which might be used for conversion into plastics, wallboards, or paper.

In 23 northeastern Ohio counties, it was found that almost 5,000 tons of waste is produced weekly. There is little doubt that there is plenty of material to supply the new uses contemplated.

There are, however, several problems to be faced before widespread use can be developed; namely, the high cost of handling, transporting, separating, and processing the material. These problems are being studied by public forestry and private industrial researchers.

There are other phases of the wood waste problem which must be solved, not by new uses for scrap materials, but by basic improvements in our harvesting and marketing methods. Waste is greatly increased by

large quantities of mis-manufactured, improperly cared for, and poorly graded lumber found on the market. It was found that the percent of waste varied greatly at different sawmills and factories because of different utilization practices. On the average, a sawmill will produce one ton of sawdust and slabs for every thousand board feet of lumber sawn. "Waste-conscious" operators are able to convert into usable products much material that would normally go into the slab pile.

Perhaps the most wasteful practice of all is that of harvesting immature trees at the point where they have just started their greatest volume and value growth. Not only is the percentage of waste high from small logs, but immature trees produce little lumber in relation to their size.

J. W. Meteer

Nursery Program Expanded

In order to meet the greatly increased demand for reforestation stock, a second nursery was purchased in Sandusky County, one mile west of Green Springs. This tract of 80 acres, when in full production, should bring the total state production to about 10 million trees per year.

Fig. 27.—Small Ohio sawmill showing mishandled lumber. Note size of sawdust pile in background.

This year, 3,602,000 trees were produced of which 1,896,000 were planted by farmers. Mining companies were the second largest planters, totalling 1,164,500 trees, with state lands in third place with 432,000.

About two thirds of the trees produced were pine, which are most suitable for planting on land which has lost most or all of its topsoil.

R. R. Paton

Fires Threat to Forest Crop

Six hundred and eighty-seven forest fires were suppressed by personnel of the Division of Forestry during the year. Out of 5,400,000 acres protected, 15,392 acres were burned during the year. Nearly half of this area was grassland, which in time would revert to forest.

Unless promptly suppressed, each fire could develop into a large and costly conflagration, which would further reduce Ohio's timber resources.

The purchase of one two-place airplane, 4 jeeps, 9 automobiles, and 13 pickups helped to improve the transportation situation in fire control work.

J. A. Bastian

New Cabins on Forest Parks

Seven new vacation cabins were opened for use at Lake Hope, while work progressed on a 14-cabin group at Pike Lake in the Pike Forest, and a 20-cabin group on the east side of Lake Hope. These last named will be sleeping cabins, as meals will be served at a large lodge which is also under construction.

Using available figures as a basis, it is estimated that the number of persons who stopped in the state forests and used recreational facilities during the year totalled 837,000, while persons on pleasure driving would raise the total to 1,320,000. The recreational use of the state forests and parks requires additional maintenance expenditures.

C. E. Bazler

Land Added to State Forests

During the past 2 years, 18,941 acres were added to the state forests and forest parks, additions having been made to 13 different units. The costs varied from $6.54 per acre for land in Brush Creek Forest in Scioto County to $94.10 per acre for land in Hueston Woods Park in Preble and Butler Counties. The average for all lands was $27.10 per acre.

As of December 31, 1947, Ohio had 86,248 acres of state forest land acquired by purchase or gift and 38,396 acres on long term lease from the Federal government.

B. E. Leete

Machine Plants Trees on the Contour

Large areas of Eastern Ohio are unsuitable for agricultural purposes and are in need of reforestation. The Muskingum Watershed Conservancy District has been carrying out a program to plant trees on 20,000 acres around the flood control reservoirs in their district. Due to shortage of labor and slowness of hand planting, means for mechanical planting is a necessity.

A mechanical tree planting machine has been developed to plant trees on the contour on steep slopes. The year before planting, a series of miniature terraces are formed on the slopes by throwing two furrows down hill with a two-way two-bottom plow.

The planting is made on top of these furrows. The wheels are separately controlled by hydraulic cylinder to allow the machine to be levelled on hillsides. The functional parts of the machine are short with a joint between the separate parts in order to allow the machine to plant around curves.

The machine was used in the spring of 1948 and planted from 800 to 1,000 trees per hour.

R. L. Erwin

Fig. 28.—Planting machine in operation on a steep slope.

Administrative Reports

PUBLICATIONS

Bulletins

670 Spraying Program and Pest Control for Fruit Crops (Supplement)
671 Onion Production in Ohio
672 Cover Crop and Sod Plus Mulch Orchard Soil Management
673 Farm Science and Practice (Annual Report)
674 Farm Science and Practice (Annual Report)
675 Crossbreeding for the Production of Market Hogs
676 Pesticides

Special Circulars

76 Reforestation in Ohio
77 The Ohio Corn Performance Tests 1945 and 1946
78 A Key to the Soils of Ohio

Farm and Home Research

Vol. 32, No. 247 July-August, 1947
Vol. 32, No. 248 September-October, 1947
Vol. 32, No. 249 November-December, 1947. (This issue contains an index for Vol. 32)
Vol. 33, No. 250 January-February, 1948
Vol. 33, No. 251 March-April, 1948
Vol. 33, No. 252 May-June, 1948

Weekly Press Bulletins

No. XXXII-19 through No. XXXIII-18

Mimeographs

Department of Agronomy

107 Trials of Sweet Corn Hybrids at Columbus, 1946
108 Buckwheat as an Emergency Crop
109 Defoliating of Soybeans and Weeds by Dusting with Powdered Cyanamid (aero defoliant)
110 1947 Sweet Corn Tests
111 Winter Wheat Report, 1947
112 The Ohio Corn Performance Tests, 1947
113 June Field Day, 1948

Department of Animal Science

55 Types of Sheep and Systems of Breeding for Southeastern Ohio
56 Purebred and Three Breed Rotation Crossbred Pigs; by (1) Outbred and (2) Inbred Sires

Department of Botany and Plant Pathology

5 Late Blight of Tomato and Its Control
6 Growing Plants in Nutrient Solutions

Department of Entomology

12 Control of Greenhouse Insects and Mites
13 Some Principles Involved in a Well-planned Experiment
14 Stone Fruit Insects Questionnaire

Department of Rural Economics and Rural Sociology

197 The Ohio Real Estate Situation
198 Production Adjustments in Ohio Agriculture for 1948
199 A Report of an Experimental Carload of Fresh Vegetables Unloaded in Columbus, Ohio, in September, 1947
200 Landlord Tenant Relations
201 Estimated Gross Cash Income to Ohio Farmers from the Sale of Agricultural Products and from Agricultural Conservation and Sugar Beet Program Payments by Counties, 1945 and 1946

Journal Articles

Alban, E. K., and H. D. Brown. Susceptibility of some of the cucurbits to DDT injury. Proc. Amer. Soc. Hort. Sci. **49**: 320-324.

————, H. W. Ford, and F. S. Howlett. A preliminary report on the effect of various cultural practices with greenhouse tomatoes on the respiration rate of the harvested fruit. Ohio Veg. and Potato Growers' Assn. Proc. **33**: 142-149.

————Alban, E. K., and V. E. Keirns. 1947. The effect of rotenone, commercial and aerosal DDT on the grade, maturity, and yield of seven cucurbit varieties. Ohio Veg. and Potato Growers' Assoc. **33**: 53-57.

———— and ————. Pre-emergence and post-emergence weed control in vegetable crops with oil and 2,4-D. Ohio Veg. and Potato Growers' Assoc. Proc. **33**: 40-47.

————, and E. B. Tussing. 1947. Weight loss of Katahdin potatoes, stored in various containers under two temperature conditions. Amer. Potato Jour. **23**: 8: 302-304.

Alexander, L. J. 1948. Progress report on the control of the tobacco mosaic disease of glasshouse grown tomatoes. Proc. Ohio Veg. Grow. Assoc. 33rd Ann. Rept. 112-128.

Bell, D. S. 1948. Infant mortality among lambs. Proc. Ohio State Vet. Med. Assn. pp. 89-96.

Bethke, R. M., D. C. Kennard, and V. D. Chamberlin. 1947. The relation of nutrition to production and hatchability of chicken eggs. III. Poultry Sci. **26**: 377-380.

————, J. M. Pensack, and D. C. Kennard. 1947. The influence of the hen's diet on growth of progeny. Poultry Sci. **26**: 128-131.

Brown, H. D., and E. K. Alban. 1947. Susceptibility of some of the cucurbits to DDT injury. Proc. ASHS., Vol. 48: 320-324.

————, Mary Brown Patton, Amelie Blythe, and M. R. Shetlar. 1947. Influence of mineral levels upon carotene and ascorbic acid contents of swiss chard grown in the greenhouse. Food Research. 12: 4-9.

————, and E. K. Alban. 1947. Susceptibility of some of the cucurbits to DDT injury. Ohio Veg. and Potato Growers Assn. Rept. 59-67.

Chadwick, L. C. 1947. Adaptability and sources of supply of some of the newer and more unusual trees. Proc. Nat'l. Shade Tree Conf. **23**: 77-86.

Comin, Donald. 1948. Humidity control in apple storages. Ohio State Horticultural Society Proc. 101.

Cutright, C. R. 1948. European red mite control for 1948. Ohio State Horticultural Society Proc. **101**: 65-74.

————. 1948. Four years of DDT. Ohio State Hort. Soc. **101**: 46-52.

Diller, O. D. 1947. Forest condition classes as applied to central hardwoods. Proc. An. Meet. Soc. of Amer. For., Washington, D. C. 404-410.

Esh, G. C., T. S. Sutton, J. W. Hibbs, and W. E. Krauss. 1947. The effects of soyalecithin on the absorption and utilization of vitamin A. Jour. An. Sci. 6: (Abstract).

Hauck, C. W. 1947. Teamwork in marketing research. Journal of Farm Economics 29: November.

Hibbs, J. W., W. D. Pounden, and W. E. Krauss. 1947. Further studies on the effect of vitamin D and of parathyroid extract, "Paroidin", on the blood changes of normal and milk fever cows at parturition. Jour. Dairy Sci. 30: 564-565. (Abstract).

————. 1947. Studies on some of the nutritional and physiological aspects of milk fever in dairy cows. Abstracts of Doctor's Dissertations. The Ohio State University press. Spring Quarter.

Hoffman, I. C. 1947. First generation tomato hybrids for greenhouse use. 32 An. Proc. Ohio Veg. and Potato Growers' Assoc. 148-153.

————. 1947. Lime, mulch, fertilizer, and water experiments in the special tomato project in northern Ohio, fall, 1945 to fall, 1946, inclusive. 32 An. Proc. Ohio Veg. and Potato Growers' Assoc. 153-176.

Houston, Rayford and L.C. Chadwick. 1947. Some results of the effect of controlled humidity, mediums, and watering methods on the rooting of cuttings of some deciduous and evergreen plants. Proc. Amer. Soc. Hort. Sci. 49: 410-416.

Hunt, C. H., Lorraine Ditzler, and R. M. Bethke. Niacin and pantothenic acid content of corn hybrids. Cereal Chemistry, 24 (5): 355-363. September, 1947.

Judkins, Wesley P. 1948. Peach orchard soil management. Proc. Ohio State Hort. Soc. 101: 119-125.

————. 1948. Results of experiments with raspberries and strawberries in Ohio. Proc. Mass. Fruit Growers Assoc. 54: (in press).

————. 1948. Soil management and fertilization for peaches. Proc. Mass. Fruit Growers Assoc. 54: (in press).

————. 1947. Strawberries—which variety shall I plant? Ohio Agricultural Experiment Station Farm and Home Res. 32 (248): 187-192.

————. 1948. What's new in strawberry growing? Proc. Ohio State Hort. Soc. 101: 170-176.

Kennard, D. C., and V. D. Chamberlin. 1948. Built-up floor litter as a source of dietary factors essential for the growth of chickens. Poultry Sci. 27: 240-243.

Kiplinger, D. C., and Vernon Gifford. 1947. Time pinching chrysanthemums. Proc. Amer. Soc. Hort. Sci. 49: 387-391.

Kroth, E. M., and J. B. Page. Aggregate formation in soil with special reference to cementing substances. Proc. Soil Sci. Amer. 11: 27-34.

Laurie, Alex, Andrew Hauge, and Willard Bryant. 1947. Prepackaging of cut flowers. Proc. Amer. Soc. Hort. Sci. 49: 427-432.

Mangus, A. R. 1947. Mental health and community nursing. Journal of Public Health Nursing. September.

Monroe, C. F., A. E. Perkins, C. E. Knoop, and R. C. Thomas. 1947. The comparative feeding value of corn silage and of corn treated meadow crop silage with and without the addition of dilute acetic acid. Jour. Dairy Sci. 30: August.

Neiswander, C. R. 1948. The present status of the European corn borer in market garden sweet corn. Ohio Veg. and Potato Growers' Assoc. Proc. 33: 48-52.

Neiswander, R. B. 1948. New developments in curculio control. Ohio State Hort. Soc. Proc. 101: 53-64.

————. 1948. New developments in greenhouse insect and mite control. Ohio Veg. and Potato Growers' Assoc. Proc. 33: 100-110.

————. 1948. Small fruit insects. Ohio State Hort. Soc. Proc. 101: 200-211.

Page, J. B., and C. J. Willard. Cropping systems and soil properties. Proc. Soil Sci. Soc. Amer. 11: 81-88.

————, ————, and G. W. McCuen. Progress report on tillage methods in preparing land for corn. Proc. Soil Sci. Soc. Amer. 11: 77-80.

Perkins, A. E., and R. G. Washburn. 1947. Silage density: Effect of pressure and crop condition. Jour. Dairy Sci. **30**: 569.

Pounden, W. D. 1947. The differential diagnosis of mastitis in the field. Jour. Amer. Vet. Med. Assoc. III December 494.

————, D. S. Bell, and R. E. Mairs. 1947. An outbreak of acute bovine listerellosis. Jour. Amer. Vet. Med. Assoc. III August 128.

————, L. C. Ferguson, C. E. Knoop, and W. E. Krauss. 1947. A further report on Staphylococcic abortions in a dairy herd. Jour. Amer. Vet. Med. Assoc. III November 376.

————, and J. W. Hibbs. 1947. Some possible relationships between management, fore-stomach contents and diarrhea in the young dairy calf. Jour. D. Sci. **30**: 582.

————, and W. E. Krauss. 1947. Staphylococcic abortion in cattle. Jour. Amer. Vet. Med. Assoc. III July 35.

————, and E. Sprunger. 1947. Malignant hemangioendothelioma of a canine spleen. North Am. Vet. **28**: 461.

Rings, Roy W., and C. R. Weaver. 1948. Recent development in oriental fruit moth control. Ohio State Hort. Soc. Proc. **101**: 74-83.

Schollenberger, C. J. 1947. Arsenate-displaceable phosphate in long-fertilized and unfertilized plot soils. Soil Sci. **64**: 371-378.

————. 1947. A glass electrode assembly for soil pH determination. Four. Assoc. Offic. Agr. Chem. **30**: 555-562.

Sleesman, J. P., and J. D. Wilson. 1948. Cucumber and muskmelon dusting experiments in 1947. Proc. Ohio Veg. & Potato Growers' Assoc. **33**: 64-68.

Stringfield, G. H., and L. E. Thatcher. 1947. Stands and methods of planting for corn hybrids. Jour. Amer. Soc. of Agron. **39**: 11.

Sutton, T. S., R. G. Warner, and H. E. Kaeser. 1947. The concentration and output of carotenoid pigments, vitamin A, and riboflavin in the colostrum and milk of dairy cows. Jour. Dairy Sci. **30**: 927-932.

————, and G. E. Esh. 1948. The nutrition of the newborn calf. I. Changes in the tryptophan content of the blood plasma following the birth of the ingestion of colostrum. Jour. Dairy Sci. **31**: 183-188.

————, and Harold E. Kaeser. 1947. The riboflavin content of cow's colostrum. Jour. Dairy Sci. **30**: 581-582.

Thomas, R. C. 1948. A method for freeing bacteria from bacteriophage. Ohio Jour. Sci. 48.

Washburn, R. G., W. E. Krauss, and C. F. Monroe. 1947. Carotene losses from artificially dehydrated alfalfa and from artificially dehydrated alfalfa silage. Jour. Dairy Sci. **30**: 568.

Wilson, J. D., and J. P. Sleesman. 1947. The differential response of potato varieties to spraying with DDT plus a fixed copper. Amer. Potato Jour. **24**: 260-266.

————, and J. P. Sleesman. 1948. Potato spraying experiments in Ohio in 1947. Proc. Ohio Veg. & Potato Growers' Assoc. **33**: 74-82.

Winter, H. F. 1948. The stone fruit virus disease situation and its importance to fruit growers. Proc. Ohio State Hort. Soc.

————. 1948. Problems in small fruit disease control. Proc. Ohio State Hort. Soc.

Yamazaki, W. T. 1947. Note on a rapid method for estimation of mixogram area. Cereal Chemistry **24**: 518-520.

Young, H. C. 1947. Recent developments in fruit disease control. Ohio Hort. Soc. Proc. **80**: 12-17.

————. 1947. Symposium on new developments in spraying and dusting machinery. Ohio Hort. Soc. Proc. **80**: 161-162.

RESEARCH PROJECTS

Department of Agricultural Engineering

Tillage.
Corn and grain storage.
Hay storage.
Soil water control.
Tree planting machine.
Plastic tile.

Department of Agronomy

Development of improved methods of breeding corn.
Field performance trials of corn hybrids.
Effect of planting method and fertility level on yield and quality of corn.
Harvesting characteristics of corn hybrids with emphasis on field shelling.
Hot weather legumes for permanent pastures.
Wheat competition in nursery tests.
Development and testing of improved wheat varieties.
Development and testing of improved oat varieties.
Development and testing of improved barley varieties.
Pastures for chickens.
Heavy fertilization of a soil-building rotation.
Rates of nitrogen for corn following grassy sods.
The Ohio soil survey.
Physical and chemical characteristics of Ohio soils.
Mineral composition of the soils of Ohio.
Fertilization of soybeans.
Defoliation of soybeans with cyanamid dust.
The Frye Farm crop rotations experiments.
Grain versus livestock system of farming.
Preliminary evaluation of new forage crop varieties and strains.
Methods of obtaining satisfactory meadow seedings in rank-growing wheat.
Sweet clover breeding and strain testing.
Smooth bromegrass culture, breeding, and strain testing.
Culture and rotation experiments with soybeans.
Control of field weeds.
Evaluation of new and standard strains of red clover.
Ground cover for use under shade trees.
Turf culture.
Fertilization of long-lay meadows.
Breeding and evaluation of improved alfalfa strains.
Time of cutting principal hay crops.
Establishing legume-grass meadows without plowing.
Rate, grade, and placement of fertilizers for sugar beets.
Crop rotations for sugar beet production.
Time and extent of seedbed preparation for sugar beets.
Use of manure, fertilizers, and residues in sugar beet production.
Use of lime, fertilizers, and manure on crop rotations on major soil types.
Mulch culture versus plowing for corn and small grain production.
Lime and phosphate studies.
Rate, grade, and placement of fertilizers in four-year rotation.
Methods of applying manure.
Rates of liming for common field crops.
Minor element fertilization of field crops.
Rate of fertilization of wheat.
Cover crops for continuous corn.

---

*The purpose of this list is to show the fields in which work is being done—the exact wording of project titles is not used in all cases.

Rejuvenation of eroded land.
Five-year fertility experiments.
Fertilization of crops in continuous culture.
Barnyard versus shed manure.
Factors in the utilization of mineral nutrients by plants.
Response of wheat varieties to climatic and soil factors.
The mineral nutrition of corn.
Sweet corn breeding.
Potash and nitrogen fertilization of corn and oats as affected by sweet clover and residues.
Production and utilization of legume-grass forage crops on the dairy farm.
Causes of soil structure deterioration and methods of restoring favorable structure.
Tillage in relation to soil structure and crop response.
Value of crop residues with sweet clover for green manure.
Processing, preservation, and utilization of meadow crop silages.
Factors influencing the success of seedings of forage crops.
Effects of fertilization and watering on yield and persistence of forage grasses and legumes.
Sub-normal soil moisture as related to failure of grass seedings.
Development and evaluation of improved soybean varieties.
Factors affecting the behavior of native and added potassium in soils.
Effect of liming on the movement and availability of potassium in soils.
The nutrition and physiology of soybeans.
Fertilizer placement for corn.
Management of greenhouse soils for vegetable crop production.
Availability of plowed-under fertilizers.
Seed corn storage investigations.
Agricultural value of blast furnace slag.
Effect of different liming materials on soils and plant growth.
Soil aeration in relation to nutrient uptake by plants.
Planned combinations of practices for red clover seed production.
Study of magnesium in soils and its effects on crop growth.
Effect of chemical and physical soil factors on the growth and development of soybeans.
Adaptation of crops under strip cropping system to livestock grazing practice (sheep).
A study of the role of green manure crops, crop residues and manure upon soil productivity when used with varying amounts of fertilizer nitrogen.
Availability of plowed under fertilizers fabricated from acid and base forming sources of nitrogen.
Daily accumulation of mineral elements in corn plants.
The effect of soybeans on soil properties.
Field trials, slope vs. contour culture of row crops.
Crop response to four levels of fertility.
Interrelationships of crop rotations, organic matter input, soil structure conditions and the internal drainage characteristics of soils.

Department of Animal Science

The use of outbred and inbred lines in hog production.
Methods of feeding pigs on pasture.
Low and high levels of protein for pigs.
Solvent extracted cottonseed meal as a protein concentrate for pigs.
Crossing inbred lines of hogs of different breeds.
Infant mortality among lambs.
Types of sheep for Southeastern Ohio.
The place of Columbia sheep in Ohio.
Meadows and pastures for hay and forage in sheep production.
Adaptation of crops under a strip cropping system of sheep grazing practice.
Systems of lamb feeding.

Legume grass silage for fattening lambs.
Crossbreeding beef cattle.
Corn and added cob meal for fattening steers.
Corn and cob meal with half a full feed of silage for fattening steers.
The vitamin B complex content of grains and forage crops as affected by kind and amount of fertilizer.
Factors affecting the niacin and pantothenic acid content of corn.
Animal products in chick rations.
Nutrition in relation to egg production and hatchability.
Rumen digestion.
Rumen bacteria survey.
Niacin and swine enteritis.

Department of Botany and Plant Pathology

Relative suitability of various fungicides for the control of vegetable diseases.
A study of fungicides and spray adjuvants for fruit disease control.
The development of disease-resistant strains of cucumbers.
The relation of bacteriophages to bacteria with special reference to plant pathogens.
Microbiological investigations of ensilage.
The pathology, physiology, and control of tomato anthracnose.
Disease resistance in the tomato: A breeding project.
Development of leaf mold resistant tomato varieties adapted for glasshouse vegetable culture in Ohio.
Cereal disease investigation.
Control of soil-borne diseases of glasshouse vegetable crops by nutrient solution culture.
Comparison of vegetable seed treatments.
Study of dust mixtures and dusting machines for vegetable disease control.
Apple measles disease or internal bark necrosis of apples.
Control of seedling diseases of sugar beets.
Apple tree root rot.
Influence of methods of application, adhesives, and leaf character on initial deposit and weathering of spray materials.
Investigation of glasshouse vegetable crops production.
Control of the tobacco mosaic disease of glasshouse-grown tomatoes.
Muck crop studies and elm and sugar beet disease studies.

Department of Dairy Industry

Pastures for milking cows.
Making and feeding meadow crop silage.
Studies on the thyroid gland.
Colostrum milk.
Mastitis.
Some vitamin analyses of market milks.
Studies on bull semen.
Mineral analysis of milk.
Study of bone and tooth ash.
Chemical studies on the blood and tissues of young calves.
Milk fever studies.
Cellular antigens of the blood.
The chemical composition of the various parts of the corn plant at ensiling stage.
Raising dairy heifers.
The use of simple grain mixtures for feeding milking cows.
Extending the period of colostrum feeding to young calves.
The anatomy of the bovine udder and teats.
Infertility in dairy cattle.
A comparison of ground soybeans and soybean oil meal when used in a simple grain mixture.

The manufacture of Swiss cheese from pasteurized milk.
The transfer of vitamin A from mother to young in dairy animals.
Systems of raising dairy calves.
The effects of manipulation of the udder on the let-down of the milk.

Department of Entomology

The insect phases of corn research.
White grubs in pastures and cereal crops.
Red spider control on vegetable crops in greenhouse and on ornamental plants.
Factors influencing codling moth incidence.
Evaluating insect resistance on varieties and strains of onion.
Evaluating insect resistance on varieties and strains of potato.
The control of the oriental fruit moth by parasitism and by insecticides.
Improvement in the control of the plum curculio as a pest of peach.
Strawberry insects (improvements in control).
The introduction of natural enemies against the Comstock's mealybug.
The control of aphids affecting apple.
Codling moth control.
European red mite.
The peach tree borer (improvements in control).
The tomato pinworm.
Nosema disease of honeybees.
Biological and chemical control of the Japanese beetle.
The biology and control of muck crop insects.
The tomato fruitworm.
The biology and control of vegetable crop insects.

Department of Forestry

Preservative treatment of fence posts.
Experimental forests.
Uses for hardwood bark.
Maple syrup production in Ohio.
Wood wastes.

Department of Horticulture

Floriculture and Ornamental Horticulture

Carnation diseases.
Causes of gardenia bud drop.
Outdoor rose studies.
Identification and adaptability of woody ornamental plants.
Value of tree paints and wound dressings.
Propagation of ornamental plants.
Effect of pre-heated water on roses and other crops.
Orchid culture.
Time pinching and duration of light on flower placement in chrysanthemums.
Cultural treatments on flower bud formation in hydrangea.
Environmental factors in relation to root and top growth of the rose plant.
Propagation of rose by cuttings.
Cooling treatments on early flowering of azalea.
Double pinch and interrupted shading as methods of producing short-stemmed disbud chrysanthemums throughout the year.
Methods of water application to ornamental plants in the greenhouse.

Horticultural Products

Suitability of Ohio-grown fruits and vegetables for processing.
Effect of soil fertility levels on the quality of processed cabbage, sweet corn, and potatoes.
Elimination of argol in processed grape products.
Development of new grape products.
Simplifying mold counting technique.
Development of grape gelatin dessert from dehydrated grape juice.
Development of fruit juice blends using Ohio fruits.

Pomology

Causes of irregular fruit setting in several representative fruit plants with particular reference to adjustments in practice.
Interrelation of auxin concentration, nitrogen content, and respiration rate to growth, fruiting, and storage of several representative plants.
Peach tree behavior under different cultural treatments as affecting soil organic matter.
Black raspberry behavior under different cultural fertilization, and irrigation treatments.
Soil factors which limit the yield of grapes in Ohio.
Control of scald and premature ripening of apples in storage.
Respiration and associated factors as indices of the marketability (shelf life) of fresh fruits and vegetables.
Minor element status of Ohio apple and peach orchards.
Influence of differential nitrogen fertilization upon leaf nitrogen, fruit size, fruit color, yield and quality of Baldwin, Delicious, and Stayman Winesap apples.
Economics of spraying.
Weather studies in relation to orcharding.
Optimum economical life of commercial apple orchards.
Orchard culture studies.
Apple variety trials.
Growth promoting substances, height of heading, and deshooting upon the development of the framework and growth of young apple trees.
Apple breeding for late blooming and late-keeping varieties.
Tests of new and uncommon pear varieties.
Time of harvesting Beurre Bosc and other pears.
Growth and fruitfulness of certain Ohio apple varieties on Malling and other dwarfing stocks and the relative value of several hardy varieties as intermediate stocks.
Caustic sprays as a method of replacing hand thinning of apples.
Synthetic hormones in relation to the pre-harvest drop of apples.
Stone and small fruit variety trials.
Soil and cultural treatments for blueberries.
Culture of cherries and plums.
Peach tree pruning and training.
Orchard culture and spraying at the County Experiment Farms.
Red strains of apple varieties.

Vegetable Crops

Development of soil structure for potatoes in silt loam.
Reduction of oxygen supply to potato roots on their oxygen consumption and growth of the plant.
Growth promoting chemicals in relation to fruit set and yield of certain horticultural plants grown for their fruits.
Storage of vegetables in bins with forced air circulation.
Respiration and associated factors as indices in the determination of the period of marketability (shelf-life) of fresh (unprocessed) vegetables.
Effect of adding vitamins, hormones, cereal products on the growth and yield of commercial mushrooms.
Breeding of greenhouse vegetables.
Experiments with tomatoes grown for canning.

Fertilizer for early vegetable crops on sandy soil.
Variation in night temperature as a factor affecting fruit setting of the greenhouse tomato and the development of blotchy ripening.
Weed control in horticultural crops.
Cultural experiments with sweet corn and lima beans grown for processing.

Department of Home Economics

The calcium phosphorus study.
The school lunch project.
Study of frozen poultry.
Sorption properties and serviceability of certain fabrics.
Laundry study.
Housing survey.

Department of Poultry Science

The special value of certain animal products in the growth of chicks.
Nutritional factors affecting the production and hatchability of hens' eggs.
Supplements to soybean oil meal for economical egg production and hatchability of eggs.
Floor litter management procedures.
Nutritional supplements in floor litter management.
Egg production, feather picking, and cannibalism as affected by the ration and method of feeding.
Egg production as affected by different sources of calcium with and without hard grit.
Finely ground versus coarse feeds for chickens.
Corn-and-cob meal as a substitute for ground shelled corn in rations for chickens.
Crossbred versus purebred chickens for meat and egg production.
Rations and management procedures for the growth of chickens.
Feed supplements to pasturage for growth of chickens.
Growth of chickens indoors versus outside range and pasturage.

Department of Rural Economics and Rural Sociology

Variations in hog prices.
Marketing feeder livestock.
Marketing slaughter livestock by carcass weight and grade.
Wastes in the distribution of fruit and vegetables.
Milk pricing.
The effect of price plans on the seasonal deliveries from the farm.
The frozen food locker and home unit locker.
Consumer acceptance of frozen foods.
The cost of producing milk.
Economizing time in dairy chores.
The income of Ohio farmers by counties.
Methods of renting land in Ohio.
Factors which influence the return from maple syrup.
The succession of son after father in farm operations.
Changes in Ohio farm land prices.
Farm taxation and local government in Ohio.
Desirable postwar adjustments for Ohio agriculture.
Health status and needs of rural people.

Department of Veterinary Science

Brucellosis in cattle.
Crystal violet vaccine for swine.
Swine enteritis.
Bovine mastitis.

Climatological Summary

Climatological summary for Ohio* and Wooster for 1947

Month	Temperature, degrees F.								Precipitation, inches			Number of days—			
	Monthly mean	Departure from average	Highest °F.	Highest Date	Lowest °F.	Lowest Date	Range	Greatest daily range	Average T	Departure from average	Average snowfall	With 0.01 in. or more precipitation	Clear	Partly cloudy	Cloudy
Wooster, Ohio															
January	32.1	+4.6	60	30	2	22	58	27	4.02	+1.05	0.75	14	4	8	19
February	22,0	—5.5	52	14	—3	8	55	40	0.40	—1.95	6.45	9	11	6	11
March	31.2	—6.5	57	23	14	18	43	30	0.91	—2.51	12.00	11	15	4	12
April	48.0	—0.3	80	5	22	7, 8	58	29	4.78	+1.75	..	16	13	5	12
May	55.8	+2.9	81	28	25	10	56	38	5.74	+1.86	T	18	16	5	10
June	67.1	—0.7	88	10	42	4	46	34	10.04	+5.97	.. ..	14	21	6	3
July	69.3	—2.5	90	14	45	23	45	30	3.65	—0.30	.. ..	12	15	11	5
August	76.2	+6.4	93	4, 5, 19	45	1	48	31	7.06	+3.47	. . . ..	10	20	7	4
September	64.3	+0.5	87	9, 11	29	27	58	34	3.73	+0.60	....	7	20	7	3
October	59.8	+7.7	82	7	29	1, 2	53	38	1.64	—0.86	.. ..	6	20	5	6
November	38.0	—1.6	60	7	11	30	49	22	2.21	—0.35	0.25	11	2	6	22
December	30.4	+0.1	54	8	11	29	43	29	1.06	—1.47	3.0	7	2	8	21
Annual	49.5	—0.1	93	Aug. 4, 5, 19	—3	Feb. 8	96	40	45.24	+7.26	22.45	135	159	78	128
Ohio															
January	34.4	+5.9	73	29	—3	22	76	....	4.74	+1.77	3.2	14	3	8	20
February	23.1	—6.3	62	14	—7	8	69	. ...	0.62	—1.96	8.1	5	7	9	12
March	33.1	—5.9	74	23	6	28	68	.....	1.68	—1.77	8.2	11	8	9	14
April	50.7	+0.9	88	5	20	8, 28	68	....	5.31	+2.10	T	14	7	9	14
May	57.8	—2.7	90	28	19	10	71	....	5.82	+2.04	T	16	9	9	13
June	67.8	—1.9	95	10	36	4	59	.....	5.55	+1.59	0	11	12	11	7
July	69.4	—4.2	98	30	41	20, 22	57	.....	3.79	0	0	12	10	12	9
August	77.3	+5.6	111	6	41	1	70	....	4.39	+1.01	0	9	13	13	5
September	66.2	+0.5	95	11	25	27	70	.....	3.37	+0.45	0	8	15	10	5
October	61.3	+7.5	90	16	22	1, 2	68	.....	1.67	—0.85	0	6	17	7	7
November	39.2	—2.3	69	10	2	30	67	.....	2.27	—0.42	1.3	12	6	7	17
December	31.6	0.0	64	3, 5	0	24, 25, 29	64	.....	1.61	—1.07	4.4	9	8	7	16
Annual	51.0	—0.2	111	Aug. 6	—7	Feb. 8	118	.....	40.82	+2.89	25.2	127	115	111	139

*Years of record for Wooster 60. For Ohio 65.
T Totals given for Wooster.
†Data for Ohio furnished by Geo. W. Mindling, Senior Meteorologist, U. S. Weather Bureau, Columbus, Ohio.

Financial Report

FISCAL YEAR ENDED JUNE 30, 1948

	Federal Funds					
	Hatch	Adams	Purnell	Bankhead-Jones	Research & Marketing	All Other Funds
Balance July 1, 1947	$ .00	$ .00	$ .00	$ .00	$ .00	$3,457,270.19
Appropriation	15,000.00	15,000.00	60,000.00	101,527.47	63,723.25	1,572,225.36*
Total	$15,000.00	$15,000.00	$60,000.00	$101,527.47	$63,723.25	$5,029,495.55
Expenditures						
Personal Service	13,199.98	13,602.90	53,423.32	83,520.13	18,046.65	976,759.74
Travel	566.63		1,623.31	666.70	1,820.56	18,451.75
Transportation	34.05	35.52	38.65	62.09		4,132.47
Communication						6,907.22
Rent and Utilities			28.20			40,415.78
Printing and Binding				65.22		6,277.00
Other Contractual Services			6.88	252.19		18,414.16
Supplies and Materials	874.34	1,067.38	3,461.18	11,949.44	1,530.86	325,707.14
Equipment	325.00	293.70	1,418.14	4,515.41	4,247.85	80,636.38
Lands and Structures				496.29		544,695.54
Funds Lapsed and Unavailable for Use						24,278.06
Total Expenditures	$15,000.00	$14,999.50	$59,999.68	$101,527.47	$25,645.92	$2,046,675.24
Balance June 30, 1948	.00	.00	.32	.00	38,077.33	2,982,820.31
Total	$15,000.00	$15,000.00	$60,000.00	$101,527.47	$63,723.25	$5,029,495.55

*Includes $767,467.68 State Appropriation for Main Station, and special outlying work, $458.250 09 for Division of Forestry, and $346,507.59 from sale of products produced by Main Station and Division of Forestry.

Station Administration and Staff

(As of June 30, 1948)

BOARD OF CONTROL

JAMES F. LINCOLN ..... *President* (Cleveland)
WARNER M. POMERENE ..... *Vice-President* (Coshocton)
DON C. POWER ..... (Columbus)
GEN. CARLTON S. DARGUSCH ..... (Columbus)
LOCKWOOD THOMPSON ..... (Cleveland)
CHARLES F. KETTERING ..... (Dayton)
HERBERT S. ATKINSON ..... (Columbus)
FRANK M. FARNSWORTH ..... (Waterville)
CARL E. STEEB ..... *Secretary* (Columbus)

ADMINISTRATION

L. L. RUMMELL, M. S. ..... *Director*
W. E. KRAUSS, Ph. D. ..... *Associate Director*
R. M. BETHKE, Ph. D. ..... *Assistant Director*
J. D. BRAGG, B. S. ..... *Administrative Secretary*
GUY HUMMON, B. S. ..... *Business Manager*
ROBERT E. YODER, Ph. D. ..... *Supervisor of Field Research*
HELEN HAHN, B. E. ..... *Librarian*
DELMER E. GROVES, B. S. ..... *Editor*
JOHN TOLK ..... *Photographer*
PAUL THOMAS ..... *Supt. of Maintenance*

AGRICULTURAL ENGINEERING
(Columbus)

G. W. MCCUEN, B. S. ..... *Chairman*
ROBERT L. ERWIN, B. A. E. ..... *Assistant*
HARRIS M. GITLIN, B. A. E. ..... *Assistant*

AGRONOMY

G. W. VOLK, Ph. D.[2] ..... *Chairman*
L. E. THATCHER, Ph. G. ..... *Associate Chairman*
M. A. BACHTELL, B. S. ..... *Associate*
E. E. BARNES, Ph. D. ..... *Associate*
C. E. BODE, M. S.[1] ..... *Assistant*
H. L. BORST, Ph. D.[1] ..... *Associate*
JOHN G. DEAN, M. S.[2] ..... *Assistant*
D. R. DODD, Ph. D.[2] ..... *Associate*
C. E. EVANS, Ph. D. ..... *Associate*
J. L. HAYNES, Ph. D. ..... *Associate*
HAROLD HEIZER, B. S.[1] ..... *Assistant*
C. A. LAMB, Ph. D.[2] ..... *Associate*
D. D. MASON, M. S.[2] ..... *Assistant*
V. H. MORRIS, Ph. D.[1] ..... *Associate*
H. HOWE MORSE, Ph. D.[1, 2] ..... *Associate*
JOHN B. PAGE, Ph. D.[2] ..... *Associate*
J. B. PARK, D. Sc.[2] ..... *Associate*
JAMES H. PETRO, B. S.[1, 2] ..... *Assistant*
C. F. ROGERS, Ph. D. ..... *Associate*
LEWIS C. SABOE, Ph. D.[1, 2] ..... *Assistant*
J. D. SAYRE, Ph. D.[1] ..... *Associate*
C. J. SCHOLLENBERGER, B. A. ..... *Associate*
R. H. SIMON, M. A. ..... *Assistant*
G. H. STRINGFIELD, M. S.[1] ..... *Associate*
F. A. WELTON, Ph. D. ..... *Associate*
C. J. WILLARD, Ph. D.[2] ..... *Associate*
J. H. WILSON, B. S.[5] ..... *Assistant*
W. T. YAMAZAKI, M. S.[1] ..... *Assistant*
ROBT. A. YOUNG, B. S.[2] ..... *Assistant*

ANIMAL SCIENCE

ROLAND M. BETHKE, Ph. D. ..... *Chairman*
D. S. BELL, M. S. ..... *Associate*
WISE BURROUGHS, Ph. D[3] ..... *Associate*
PAUL GERLAUGH, M. S. ..... *Associate*
J. W. HIBBS, Ph. D. ..... *Assistant*
C. H. HUNT, Ph. D. ..... *Associate*
L. A. KAUFFMAN, M. S.[2] ..... *Assistant*
L. E. KUNKLE, M. S.[2] ..... *Assistant*
D. C. RIFE, Ph. D.[2] ..... *Assistant*
W. L. ROBISON, M. S. ..... *Associate*
LORRAINE D. RODRIGUEZ, M. S. ..... *Assistant*
T. S. SUTTON, Ph. D.[2] ..... *Associate*

BOTANY AND PLANT PATHOLOGY

B. S. MEYER, Ph. D.[2] ..... *Chairman*
H. C. YOUNG, Ph. D. ..... *Associate Chairman*
L. J. ALEXANDER, Ph. D. ..... *Associate*
R. S. DAVIDSON, Ph. D. ..... *Assistant*
H. A. RUNNELS, M. S. ..... *Assistant*
R. C. THOMAS, M. A. ..... *Associate*
J. D. WILSON, Ph. D. ..... *Associate*
H. F. WINTER, B. S. ..... *Assistant*

DEPARTMENT OF VETERINARY SCIENCE
(Reynoldsburg)

BRUCE H. EDGINGTON, D. V. M. ..... *Chairman*
JOHN N. BUKER, D. V. M.[2] ..... *Assistant*
C. R. COLE, D. V. M., Ph. D. ..... *Assistant*
NORMA A. FRANK, M. S. ..... *Assistant*
HARRY G. GEYER, D. V. M.[2] ..... *Associate*
JOHN H. HELWIG, D. V. M. ..... *Assistant*
NELSON B. KING, D. V. M. ..... *Assistant*
F. R. KOUTZ, D. V. M., M. S. ..... *Assistant*
WALTER R. KRILL, D. V. M.[2] ..... *Associate*
GEORGE S. MECHLING, D. V. M. ..... *Associate*
W. D. POUNDEN, D. V. M., M. S. ..... *Associate* (Wooster)
R. E. REBRASSIER, D. V. M., M. S.[2] *Associate*
W. G. VENZKE, D. V. M., Ph. D. ..... *Assistant*

DAIRY INDUSTRY

FORDYCE ELY, Ph. D.[2] ..... *Chairman*
C. F. MONROE, M. S. ..... *Associate Chairman*
L. H. BURGWALD, B. S.[2] ..... *Associate*
L. C. FERGUSON, D. V. M., Ph. D.[2] ..... *Associate*
HOMER GALL[2] ..... *Assistant*
J. W. HIBBS, Ph. D. ..... *Assistant*
C. E. KNOOP, M. S. ..... *Assistant*
A. E. PERKINS, M. S. ..... *Associate*
W. D. POUNDEN, D. V. M., M. S. ..... *Associate*
W. L. SLATTER, M. S.[2] ..... *Assistant*
R. B. STOLTZ, B. S.[2] ..... *Associate*
T. S. SUTTON, Ph. D.[2] ..... *Associate*
R. G. WASHBURN, B. A. ..... *Assistant*

ENTOMOLOGY

D. F. MILLER, Ph. D.[2] ..... *Chairman*
C. R. NEISWANDER, Ph. D. ..... *Associate Chairman*
C. R. CUTRIGHT, Ph. D. ..... *Associate*
R. B. NEISWANDER, Ph. D. ..... *Associate*
J. B. POLIVKA, Ph. D. ..... *Assistant*
C. A. REESE, B. S.[2] ..... *Assistant*
ROY W. RINGS, Ph. D. ..... *Assistant*
J. P. SLEESMAN, Ph. D. ..... *Assistant*
ROBERT SUTTON, M. S. ..... *Assistant*

FORESTRY

O. A. ALDERMAN, M. F. .... *Chief (State Forester)*
W. R. ANDERSON, M. S. .... *Assistant*
EARNEST A. AUSTIN[1] .... *Assistant*
CARL BAILEY .... *Assistant* (Green Springs)
JAMES BALL, B. S.[1] .... *Assistant*
J. A. BASTIAN, B. S. F.[4] .... *Associate*
CARROLL BAZLER, B. S.[1] .... *Associate*
B. H. BENTLEY, B. S. F.[1] .... *Assistant*
JESSE M. BYRD, B. S. F. .... *Assistant* (Athens)
EMMETT CONWAY, M. F.[4] .... *Assistant*
ARTHUR E. DAY .... *Assistant*
I. I. DICKMAN .... *Assistant* (Athens)
O. D. DILLER, Ph. D. .... *Associate*
TURE L. JOHNSON, B. S. F. .... *Assistant* (Burton)
B. E. LEETE, M. F.[4] .... *Associate*
RICHARD LINDL, B. S. F. .... *Assistant* (Bowling Green)
G. C. MARTIN .... *Assistant* (Marietta)
JOSEPH MASTERS, L. L. B. .... *Assistant*
JAMES W. METEER, M. F. .... *Assistant*
J. E. MCLAUGHLIN, C. E.[4] .... *Assistant*
E. W. MILES, B. S. F.[1] .... *Assistant*
W. N. MOULTON, B. S. F.[4] .... *Assistant*
J. F. NEEDHAM, B. S. F.[4] .... *Assistant*
G. T. O'MALLEY, B. S.[4] .... *Assistant*
ROBERT R. PATON, M. F. .... *Associate*
HOWARD PECK[4] .... *Assistant*
ROBERT REDETT, B. S. F. .... *Assistant* (Lisbon)
DONALD RICHTER, B. S. .... *Assistant* (Marietta)
ELBERT SCHORY, B. S. F. .... *Assistant* (New Philadelphia)
W. O. SCHRAMM, B. S. F. .... *Assistant*
EDMUND SECREST, D. Sc. .... *Consulting Forester*
J. D. WELLS .... *Assistant* (Logan)

POULTRY SCIENCE

E. L. DAKAN, B. S.[2] .... *Chairman*
D. C. KENNARD, B. S. .... *As ociate Chairman*
R. M. BETHKE, Ph. D. .... *Associate*
V. D. CHAMBERLIN, B. S. .... *Assistant*
R. G. JAAP, Ph. D.[2] .... *Associate*
A. R. WINTER, Ph. D.[2] .... *Associate*

HORTICULTURE

FREEMAN S. HOWLETT, Ph. D. .... *Chairman*
E. K. ALBAN, Ph. D.[2] .... *Assistant*
JOHN A. ALGER, B. S. .... *Assistant*
RICHARD BARTON, M. S. .... *Assistant*
JAMES BEATTIE, Ph. D. .... *Assistant*
H. D. BROWN, Ph. D.[2] .... *Associate*
JOHN BUSHNELL, Ph. D. .... *Associate*
L. C. CHADWICK, Ph. D.[2] .... *Associate*
DONALD COMIN, M. S. .... *Assistant*
C. W. ELLENWOOD .... *Associate*
RAYMOND HASEK, M. S.[2] .... *Assistant*
I. C. HOFFMAN, Ph. D. .... *Assistant*
WESLEY P. JUDKINS, Ph. D. .... *Associate*
D. C. KIPLINGER, M. S.[2] .... *Assistant*
ALEX LAURIE, M. S.[2] .... *Associate*

HOME ECONOMICS (Columbus)

GLADYS BRANEGAN, Ph. D. .... *Chairman*
VIRGINIA DAVISON, M. S. .... *Assistant*
LOIS GUNN, M. S. .... *Assistant*
VIRGINIA R. NORTON, B. S. .... *Assistant*
MARY BROWN PATTON, M. S. .... *Associate*
FLORENCE PETZEL, A. M. .... *Assistant*
INEZ PRUDENT, Ph. D. .... *Associate*
ELAINE KNOWLES WEAVER, Ph. D. .... *Associate*
EVA DONELSON WILSON, Ph. D. .... *Associate*

RURAL ECONOMICS AND RURAL SOCIOLOGY (Columbus)

J. I. FALCONER, Ph. D. .... *Chairman*
R. H. BAKER, M. S. .... *Assistant*
ELMER BAUMER, M. S. .... *Assistant*
M. B. EVANS, M. S. .... *Assistant*
C. W. HAUCK, Ph. D. .... *Associate*
R. C. HEADINGTON, Ph. D. .... *Assistant*
G. F. HENNING, Ph. D. .... *Associate*
J. R. KENDALL, B. S. .... *Assistant*
W. L. LENOX, M. S. .... *Assistant*
A. R. MANGUS, Ph. D. .... *Associate*
C. G. MCBRIDE, Ph. D. .... *Associate*
H. R. MOORE, M. S. .... *Associate*
R. W. SHERMAN, Ph. D. .... *Assistant*

DISTRICT AND COUNTY EXPERIMENT FARMS

THOMAS F. WONDERLING, B. S., *Supervisor*

Manager	*Farm*	*Location*
HENRY MCMAHON	Belmont Co. Exp. Farm	St. Clairsville
HOWARD S. ELLIOTT	Clermont Co. Exp. Farm	Batavia
CECIL W. FRYMAN	Hamilton Co. Exp. Farm	Mt. Healthy
H. W. ROGERS, B. S.	Madison Co. Exp. Farm	London
L. W. SHERMAN, M. S.	Mahoning Co. Exp. Farm	Canfield
PERLE A. JONES	Miami Co. Exp. Farm	Troy
PAUL W. JOHANNS	Paulding Co. Exp. Farm	Paulding
WALTER LIVEZEY	Trumbull Co. Exp. Farm	Cortland
HAROLD M. RACER	Washington Co. Exp. Farm	Fleming
ORRIN NICHOLS	Northwestern Exp. Farm	Holgate
L. S. POWELSON	Southeastern Exp. Farm	Carpenter
HARVEY L. WACHTER	Southwestern Exp. Farm	Germantown
EDWARD POSTEMA	Muck Crops Exp. Farm	Celeryville
HAROLD M. RACER	Washington Co. Truck Exp. Farm	Marietta
H. W. BLACK, *Proj't Supervisor*	Soil Conservation Exp. Farm	Zanesville
	Northeastern Experiment Farm	Strongsville

[1]In Cooperation with the U. S. Department of Agriculture.
[2]Stationed at Columbus.
[3]Stationed at the Reynoldsburg Animal Disease Laboratory.
[4]Stationed with the Ohio Division of Forestry at Chillicothe.
[5]Also Station Climatologist.